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Electricity in Ships

OF the claims made for the pre-eminence of the *Queen Mary* among the ships of all time, none has been more consistently or more justly emphasised than those relating to her electrical gear.

That this is not a case of the national wish being father to the common thought will be clear from the particulars given in this issue, and also from a comparison with the original installation on a famous predecessor. Although the gross tonnage of the *Aquitania* is as much as 45,000, the capacity of her turbo-generators is less than a fifth of that on the new Cunard-White Star liner and appreciably below that of her heating and cooking load alone.

Progress is not, however, to be measured merely in kilowatts. Thus, to say that three times the number of lamps are in use does not even approximately indicate the advance in illumination, which, in addition to its utilitarian aspect, is now integral with the decorative scheme.

In the attention paid to the luxury requirements of passengers of all classes, it would be easy to lose sight of the part played by electric motors in operating the vessel. The horse-power is eight times that found enough on the *Aquitania*, while the output of electrically driven deck machinery is actually more than a hundred times greater. This reflects the reduction in size and weight of motors for a given duty in recent years, no less than their ability to withstand the most severe conditions.

One thing that has often been overlooked in the past, sometimes with troublesome results, is the importance of laying out the cable runs at the outset as an essential part of the scheme, but in the present case this seems to have had as much consideration as the pipework, and should form a model for future practice.

Electricity might be said, with one reservation, to have come into its own in the *Queen Mary*. This reservation is that the propellers are not electrically driven. Had they been, a total generator capacity approaching 150,000 kW would have been called for. The North Atlantic service does not provide an easily made out case for electrical propulsion, as the major factors that favour this method on other routes are absent. Nevertheless, we may hope that when the projected sister ship is laid down due weight will be attached to less prominent advantages, such as greater flexibility in the arrangement of the machinery (possibly releasing valuable cargo space), relative freedom from vibration in heavy seas, and the possibility of using higher steam conditions to offset the lower capital and fuel costs, when running at full speed, of the geared turbine.

The magnitude of the propulsion load, however, should not obscure the truth that the value of electricity is not to be reckoned in kWh consumed. In the variety of its applications, some of them quite small current users, an example is set on the *Queen Mary* that will not be lost on the passengers, whether as consumers of electricity at home or as electrical engineers seeking new ways of solving old problems.

A Wise Decision

A FEW months ago the Council of the Electrical Contractors' Association decided that this year it would not hold its annual conference on the usual lines, but would arrange some sort of a meeting in London. Having regard to the popularity and undoubted success of the previous conferences, we could not help thinking that the Council had taken a wrong decision. After all, apart from the annual dinner, the E.C.A. members have no other opportunity of meeting one another and showing the world that they are a national body. Fortunately, the Council has now realised the undesirability of allowing this annual function to lapse, or to be "trimmed" in any way, and at the eleventh (or, at least, the tenth) hour has announced that a real conference will be held in Folkestone in July. This will enable the Association to demonstrate to the rest of the industry that it is still a live body, actively participating in the industry's affairs. If it had adhered to its previous decision the

Council would have been in grave danger of creating an impression that the E.C.A. was receding instead of still advancing, as is actually the case. The provisional programme, which is dealt with in this issue, shows that the usual lines will be followed, and we have no doubt that the response will amply justify the Council's altered attitude.

Distribution Voltages

ALTHOUGH supplies were being given at more than forty voltages in 1933-34, as shown in the new volume of Engineering and Financial Statistics which we review this week, progress towards standardisation in this respect (which many engineers regard as the most urgently needed reform in distribution) goes ahead. These figures include both a.c. and d.c. systems and also pairs of associated voltages, while the total number of undertakings declaring the standard of 400/230 V. three-phase had increased to 394 from 82, at which it stood in 1922-23. Much work has been done in this direction during the last two years, and it is to be hoped that the authorities declaring five or more voltages are now fewer than forty-six. The value of apparatus owned by undertakings alone on consumers' premises is now approaching the expenditure on the whole of the grid; it might well have been much greater but for the voltage handicap, since while it is bad enough to have different voltages in neighbouring areas, several on the same supply system makes things much too difficult for consumers, as well as for contractors.

Efficient Seeing

Two rule-of-thumb methods of estimating the amount of light desirable were produced as side issues of the Illumination Design Course held recently. First, the E.L.M.A. light-sight tester showed that nearly two-thirds of those attending the course chose over 50 ft.-candles for reading, although the average age appeared to be well below that at which the amount of light required for comfort notably increases (see the new handbook of the Lighting Service Bureau entitled the "Science of Seeing"). The second point brought out was that in shops the intensity of illumination at the selling plane should be four or five times that necessary for adequate general illumination; *e.g.*, if the latter is 10 ft.-candles there should be at least 40 ft.-candles on the counter. These are likely to be useful as preliminary guides, even if closer investigation into the particular conditions calls for subsequent modification.

Electricity Sales Help Industry

THOUGH there are many branches of electrical industry, it has frequently been stressed that the one particular branch which brings work to practically all classes of manufacturing is electricity supply. Those two words are doubtless bound to grow in comprehensiveness as industrial installations and railway electrification become more general. All who labour to add consumers and increase consumption are helping to expand the industry. In these remarks we are merely saying in other words what has been said in a variety of ways for years past, but concrete evidence in support of the statement is to be found in the increased prosperity of electrical manufacturing companies. Examples lie before us this week in the speeches of the chairmen of two electrical companies.

Manufacturing in 1935

BIGGER turnover, however, may not produce a proportionately increased rate of profit, when prices of raw materials are rising and competition is becoming ever keener. Mr. G. L. Wates, the chairman of Johnson & Phillips, Ltd., told his shareholders that the company's orders booked during 1935 were 63 per cent. better in value and in number than for the year 1932, but low prices prevented the total profit from increasing in that proportion. Cable prices, in particular, were low; they fell in the depression following the national crisis of 1931 and had been only modestly raised since. The speaker was able to report substantially increased transformer and switchgear turnover and steady progress in water-heating business, while sales of condensers in 1935 were treble those of 1934, business being good with leading industrial users and in the Indian and Australian markets. Subsidised foreign competition in enamelled wire calls for more adequate tariff protection. Last year's falling off in line erection work was but temporary, and the contracts now in hand largely exceed those of a year ago. J. & P. electricity supply subsidiaries are doing well, and can hardly fail to continue to do so; capital expenditure upon their development is planned for this year. The overseas department also showed a very marked increase—South Africa nearly doubled its requirements. Sir Philip Dawson followed the chairman with most encouraging statistics regarding five years' growth of consumption of electricity and a forecast of far greater things in store for the next few years.

No Saturation Yet

THE same optimism ran through the speech of Mr. J. W. Terry as he told of the growing popularity of electricity owing to the amenities which it afforded the public. Saturation point in the United Kingdom was far from reached. His company, London Electric Wire Co. & Smiths, had experienced the benefits of a year of improved trading conditions and steady sales advance for its products, but less intensive competition for a number of lines would have meant a record profit as well as a record output. Improved trade more or less naturally brought with it a rise in prices of raw materials—copper was the company's main interest in this connection, and it stood twenty per cent. up at the end of the year.

Jet-Wave Rectification

THE principles and applications of the mercury-jet wave mutator have been discussed in these columns by Mr. W. E. French, who has been carrying out investigations for several years in this country. His last article, which related to its potentialities for high-voltage d.c. transmission, appeared in our issue of January 10th. In a recent *Bulletin* of the Société Française des Electriciens Professor J. Hartmann, who has been responsible for the development of the mutator on the Continent, considers its use for various purposes. One of the most promising fields appears to be in the electro-chemical industry, where efficiencies as high as 92 per cent. at 220 V and 94 per cent. at 500 V are said to have been obtained. For this class of work fractional savings in the cost of conversion from a.c. to d.c. are often of the greatest importance.

The Homopolar Dynamo

IN a fixed circuit exposed to a cyclically varying magnetic field the flow of electricity due to increase of flux should, in accordance with the usual idea of electromagnetic induction, be balanced by that due to decrease. This would prevent the generation of a balance of unidirectional current, such as was attempted by some inventors in the early days of the dynamo. A note added by Dr. H. S. Hatfield to the reprint of a paper which he read earlier this session before the Physical Society suggests a departure from the orthodox conception due to the "Hall effect" (the influence of a magnetic field upon electrical conductivity). He points out that if the strip coil used for his experiments was replaced by a hollow cylinder the direction of flow of induced currents would not be quite at right angles to the field and to its motion, and that this would apply to the homopolar dynamo. It is shown that the Hall current can be regarded as the peripheral component of the primary current, the direction of which is changed from axial to spiral. This explanation of the Hall current seems simpler than others, although not free from complications of its own.

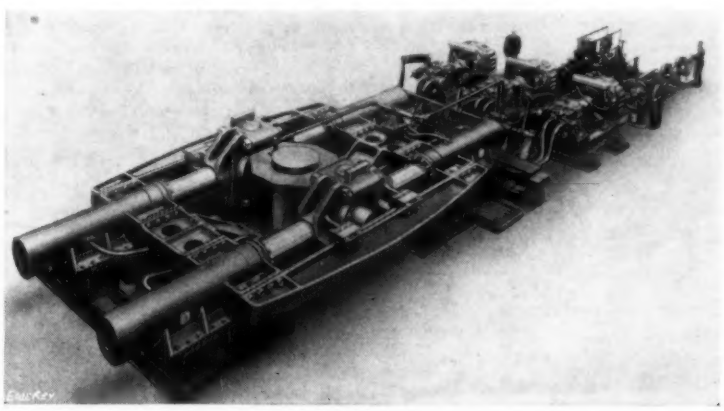
The "Queen Mary"

DETAILS OF THE ELECTRICAL EQUIPMENT

THE starting of the Cunard White Star liner *Queen Mary* on her maiden voyage across the North Atlantic at the end of this month will represent the culminating point of seven years of engineering investigation and experiment without precedent in the history of the British Mercantile Marine.

In this article we deal with the part played by electricity in administering to the comfort and safety of passengers and in operating the auxiliary machinery. This part is a very large one since, except for the driving of the propellers, the *Queen Mary* can justly be described as "all-electric." In aiming to provide accommodation at least equal to that of any hotel ashore, the owners and the contractors, John Brown & Co., Ltd., determined to provide an electrical installation on a scale not found in any existing vessel and one that it matched only by the elaborate character of the electrical methods for handling a twelve-decker 1,018 ft. long and 118 ft. beam.

Electricity is supplied by seven 1,300-kW, 225-V, d.c. generators, gear-driven at 600 r.p.m. by ten-stage 5,000-r.p.m. turbines, with which the condensers form integral units on the same floor level. All sets were supplied by the British Thomson-Houston Co., Ltd. Four of them in the aft engine room take steam from the main range at 370 lb. per sq. in. gauge and 600 deg. F. These supply power for the auxiliaries required for the propulsion machinery and other purposes. The remaining three sets in the forward engine room (170 ft. from the other), which provide the hotel services, are operated in port as well as at sea and receive steam at 230 lb. per sq. in. gauge and 650 deg. from three Yarrow double-ended cylindrical oil-fired boilers (17 ft. 6 in. dia. by 22 ft. long), each having eight corrugated suspension furnaces.



Electric hydraulic steering gear (Brown Bros. & Co., Ltd.)

Two eight-cylinder 850-r.p.m kerosene engines of the Parsons Oil Engine Co., Ltd., driving 75-kW B.T.H. generators, are installed at the aft end of the ship for emergency use with a 12-V electric starting system. For supplying the two low-voltage ring mains (each consisting of a pair of 19/.064 cables) for telephones, call bells, fire alarms and clocks, two 2 kW, 25-V motor generators have been provided with a nickel-iron 100 Ah battery as a standby.

The 225-V generators are connected to switchboards manufactured by Whipp & Bourne, Ltd., placed on platforms immediately above them by copper bars of 7.5 sq. in. sectional area per pole. The main switchboard for the auxiliary system is 46 ft. long and is equipped with circuit-breakers that can be swivelled out for inspection. Positive breakers are hand-operated and negative are solenoid controlled. Instantaneous opening of selected circuits is arranged in order to relieve the generators of load if one of them should fail. Switches and fuses controlling the distribution ring mains and other circuits are fitted on each side of the generator panels. The hotel-service board is generally similar, but is 37 ft. long.

The emergency switchboard is divided into a generator and a feeder section which are remote from one another and cannot be electrically connected unless an emergency generator is running. The feeder section is normally fed from the hotel system, but is automatically transferred to the auxiliaries system should the former supply be interrupted and in the last resort to the emergency system. Interlocks prevent the paralleling of the different systems.

Thirty-eight auxiliary boards on the machinery decks (also by Whipp & Bourne) are normally supplied from the hotel service. About 25,000 fuses are used on Aeroflex distribution boards of Parmiter, Hope & Sugden's make.

For distribution, two ring mains, consisting of from two to seven 0.1 sq. in. cables per pole, are run on porcelain insulators, as are the larger sub-mains. Rubber-insulated cables have been used throughout, as owing to the length of the vessel and the placing of the hotel-service generating plant considerably forward of the electrical centre, advantage cannot be taken of the higher current densities permissible with paper or cambric insulations. The sizes of the distribution cables vary from 1/.036 to 127/.103 in. and some have as many as twenty cores.

More than 600 miles of the 735 miles of cable used was supplied by Callender's Cable & Construction Co., Ltd. For the greater part of the installation they are v.i.r. insulated, taped and braided 600-megohm grade "Vicma" cables finished with fire and weather-resisting compound. Cables for connecting motors and certain other equipment are lead-alloy sheathed and single-wire armoured. In the Turkish baths a rust-resisting cable is employed. The quota contributed by British Insulated Cables, Ltd., includes that run in the crew's quarter in solid-drawn galvanised-steel tubing and amounts in all to about one hundred miles.

The utilisation of "Harco" perforated steel plates manufactured by G. A. Harvey & Co. (London), Ltd., has obviated the need of drilling for cable supports for a length of 8¼ miles.

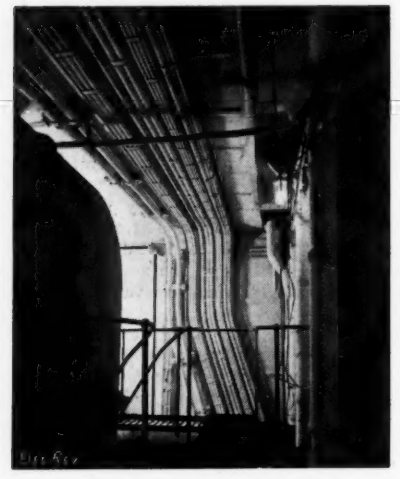
Electric motors installed, excluding the several hundred fractional h.p. motors driving cabin fans, &c., number 578 with a total h.p. of 17,816. Their allocation by numbers and h.p. (in brackets) is as follows: Engine and boiler rooms, 114 (8,597); ventilation, 254 (1,507); deck machinery, 28 (5,768); steering gear, 3 (750); kitchen, refrigerating and miscellaneous machinery, 115 (446); and boat hoists, 64 (743). In addition, there are 1,450 kW of cooking apparatus, 420 kW of radiators, and 29,000 lamps to be supplied.

In the accommodation for cabin-class passengers, the general illumination is supplemented by lamps, supplied from separate fuses and insulated switches at the dressing tables, bed-heads and wardrobes. Architectural strip lighting has been largely employed in this class and unbreakable Rcanoid shades are in general use. Electric convector heaters, curling-

tong heaters, and fans are installed in the cabins and electrically heated towel rails in the bathrooms.

Four Edison Swan "Juno" 1,000-W floodlight projectors on the bridge-house light the ship's side and centre when the life-boats are launched. Twenty-four inspection lanterns and twelve 300-W overside lights are fed from the port and starboard emergency circuits and controlled from the bridge illuminating the boats. Floodlighting of the funnels and bridge front can be carried out by fifteen 1,000-W B.T.H. projectors.

Much of the decorative aspect of the passenger quarters is due to the lighting and the lighting fittings, which have been selected to correspond with the architectural treatment. Generally the idea is the most effective combination of direct and indirect systems, and one of the most striking of these schemes is that in the main restaurant, which occupies the width of the ship and is 160 ft. long. Two torchieres provide the chief service of indirect light on the high-level centre; these are equipped with silvered glass "Gecoray" reflectors and "Osram" projector lamps. Auxiliary lighting takes the form of six concealed cornices and twenty-two flush ceiling fittings. The low-level area is illuminated by trough lights with opal glass.



A section of the cabling

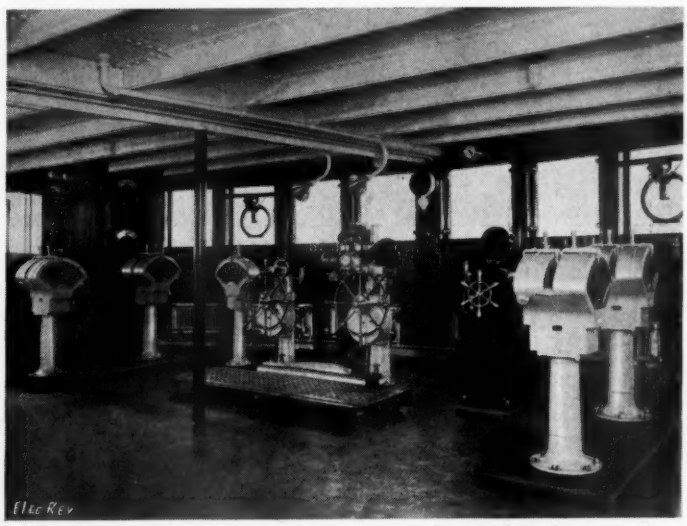
The main lounge has fourteen flush laylights in the ceiling, the surface of which is directly illuminated by twenty-eight reflector fittings recessed in the frieze. Eight circular vase-shaped bronze pylons augment the lighting in the central area, while eight soffit lights between the high and low-level ceilings, concealed casettes, and window-curtain lights complete the scheme.

A novel item in the smoke room is the use of bronze lamp troughs to intersect panels of mirror glass in the frieze. Eight sconce brackets provide indirect illumination for the central area and the lower ceiling has direct lighting units incorporated in the ventilation inlets.

In the ball-room a white crystal-glass fitting with clear and coloured lamps occupies the centre of the ceiling. Surrounding the ceiling is a continuous trough containing similar lamps.

The swimming pool relies mainly upon indirect illumination from Gecoray reflectors and "Osram" projector lamps in faience bowls built into columns on each side. The General Electric Co., Ltd., which supplied decorative lighting fixtures in these rooms, also provided equipment for the private dining rooms forward, galleries and vestibules for cabin-class passengers and the fittings in the public rooms of the tourist class and many attractive schemes in the third class rooms.

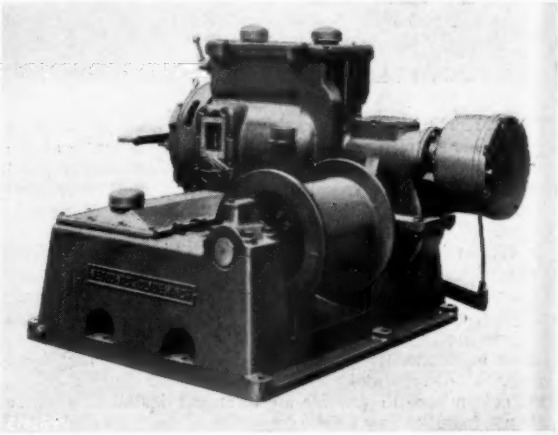
In the tourist quarters the lighting fittings are largely in matt finished silver-bronze with flashed opal glassware. The dining room (80 ft. by 100 ft.) may be selected as an example; in this, three 5-ft. diameter ceiling units are in the centre and three in each of the port and starboard bays supplemented by fourteen similar but smaller fittings and thirty-four soffit lights. The dining saloon for the third-class passengers is lighted by ceiling fittings, wall brackets and accessory units.



View showing some of the ship's electric telegraph gear, the complete system of which was supplied by Siemens Bros.

Some hundreds of special fittings by the British Thomson-Houston Co., Ltd., are employed for housing "Mazda" lamps for many of the public rooms, staircases and entries for the cabin class and for the tourist deck shops. One of these fittings weighing nearly half a ton and 5 ft. in diameter is the central feature of the main hall of the cabin class on the promenade deck; in its three tiers of moulded glass are forty-four 40-W pearl lamps. There are also a number of similar fittings 3 ft. in diameter. Numerous fittings were also manufactured by Falk, Stadelmann and Co., Ltd., and there are thousands of Cosmos, Siemens and Royal Ediswan lamps used.

Shop lighting in this part of the boat was also done by the B.T.H. Co. One of its best efforts is the circular fitting (3 ft. 9 in. diameter) in the verandah grill restaurant; this is constructed of coloured sections of ½ in. plate glass bearing an etched design. A small dance floor in the middle of this room is surrounded by a glass balustrade in which are installed



One of the three "Metrovick-Clyde" worm-geared mail and baggage winches

156 15-W coloured sign lamps. Main white lighting is furnished by 296 15-W lamps in built-in indirect cornices and coloured lighting by 264 15-W lamps. This lighting is controlled, as is that in the principal ball room, by a thyratron-reactor dimmer. The anode circuit of the thyratron is connected directly to a source of a.c. from which it takes power to supply d.c. to one winding of a laminated four-leg saturable iron-cored reactor, the other winding is in series with the lamp circuit (the load on which may be up to 16 kW). The lamps are dimmed by operating a remote-control device (delivering less than 1-W) which causes the voltage supplied to the thyratron to be lowered, thus reducing its rectified output. Hence the flux due to d.c. in the iron core is low and the reactance of the a.c. winding high. This method permits of the correct proportional dimming of colour combinations and also of cyclic variation of colours, an adjustable-speed motor operating three variable voltage devices for the grid circuits.

Depression of a "sound" push-button brings into play an amplifier the output of which feeds the grid circuits. Microphones in the ballroom and the verandah grill provide an audio-frequency input to the amplifiers. Amplifier output is divided into three channels, according to frequency, by an electrical filter, each channel providing the controlling voltage for a thyratron circuit to operate one group of coloured lights. As amplitude of sound determines the intensity of illuminations, the scheme gives a colour-mixing system, automatically controlled by the orchestra.

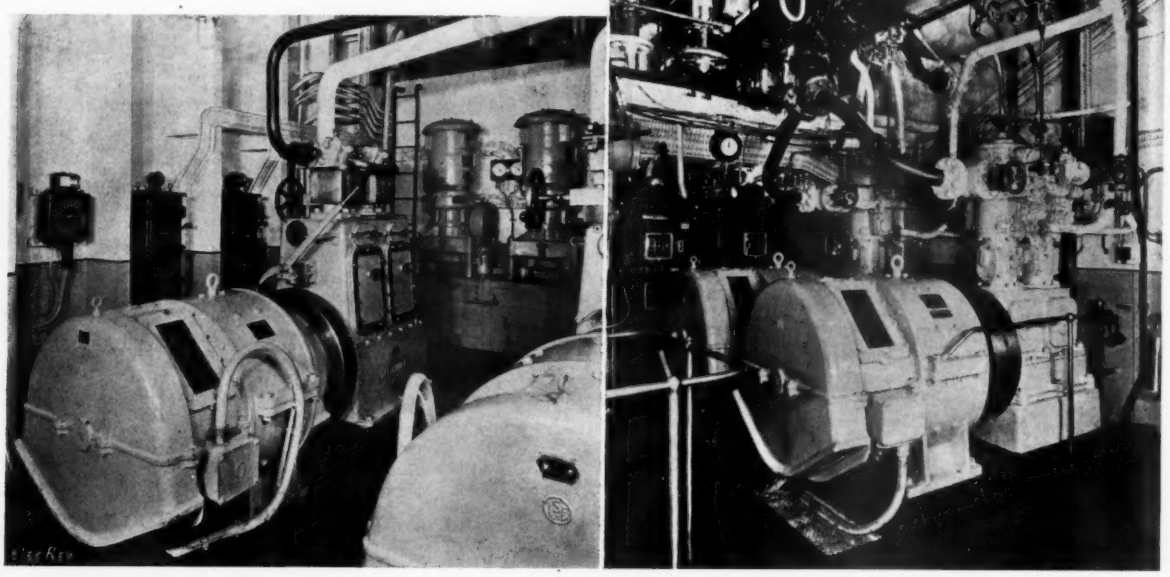
Two-stage lighting equipments have been provided by the Strand Electric and Engineering Co., Ltd. In the cabin-class lounge this includes footlights, two battens, dips and front-of-

Some of the Generating and other Electrical Plant in the "Queen Mary"

1. Motor alternators for wireless telegraphy and the thyratron control of public-room lighting. 2. Telegraphs in the forward engine room. 3. Steering gear switchboard. 4. Emergency feeder panel. 5. Emergency generator room. 6. The aft turbo-generator room

house lighting. The stage is smaller in the tourist lounge and the apparatus less elaborate, but the scheme is completed with four-colour stage lighting and three-colour decorative lighting in the lounge itself.

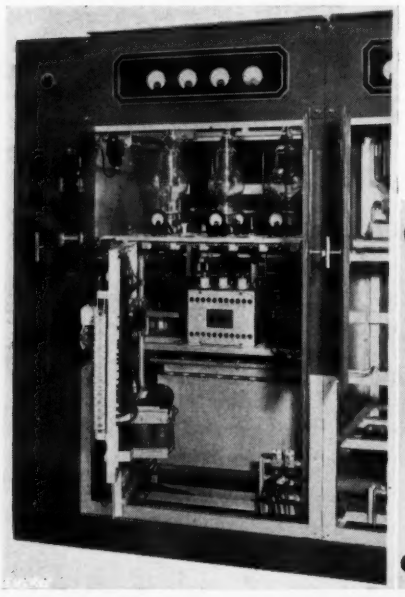
The luminous call system for the passenger accommodation includes 2,500 indicator lamps in 685 fittings. There are also seventeen wood-cased bell indicators with 175 ways and 137 fire and other alarm bells. For installation in limited space use is made of "Dis-co-Bells," which with the other items in this paragraph, has been supplied by Gent & Co., Ltd.



Left: 64-h.p. refrigerator motor and two 70-h.p. compressor motors (Laurence, Scott & Electromotors, Ltd.)

In deciding the type of heating to be employed for special suites and staterooms, avoidance of risk of fire and of damage to decorative surfaces due to overheating were kept in the forefront. The heating element of the Thermovent low-temperature unit (which was the type selected in accordance with the view that blackening of walls is due to dust electrostatically charged when radiant heat is absorbed) is housed within the vertical part of a cowl-shaped metal vent surrounded by an intermediate vent and an outer casing.

Radiant heat not transformed into converted heat in the central vent is absorbed by the walls of the outer vents, causing further convection, the temperature gradient being from 400 deg. F. to that of the room. No conduction of heat takes place between the vents. A glow-panel which is fitted in the air inlet grille gives a realistic effect of luminous heat.

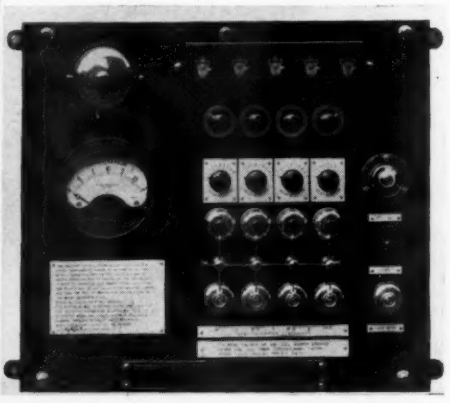


The cooking apparatus is the product of Henry Wilson & Co., Ltd., and incorporates B.T.H. "Torribar" elements. In the cabin-class kitchen are two eight-oven island ranges and one three-oven single-fronted range. All are constructed of heavy steel angles and plates cased outside in dull-polished "Staybrite" steel and finished with mirror-polished mountings of the same material; they are built in single-oven units with hotplates and switchboard. The fronts of the control panel open outward for rapid inspection of the electrical connections, which are mainly of pure nickel rod or nickel flex covered with "Ballsok" beads. At one end of each of the large ranges there is a nickel bain-marie heated by immersion elements.

Eight steam-jacketed boilers (two tilting) are designed to give complete freedom from crevices. The lining which contains the soups is of pure nickel and the outer jacket of cast-iron. Steaming ovens, salamanders, fish fryers, a whisking machine and a ham-cooker are among the other electrical apparatus installed.

The tourist kitchen on the centre line of the ship farther aft is similarly equipped; so is the third-class kitchen, but the apparatus is of plainer finish. There are also a kitchen for kosher cooking and a small kitchen for serving the verandah grill restaurant. Wood has been eliminated from all kitchens in favour of metal, usually "Staybrite" steel. The baker's shop is furnished with a battery of electrically heated ovens each with two chambers to deal with different varieties of bread. One of the chambers has a swing door and flat sole plate, and the other has a vertically sliding door and sloping sole plate. Both are internally lighted and fitted with steam sprays.

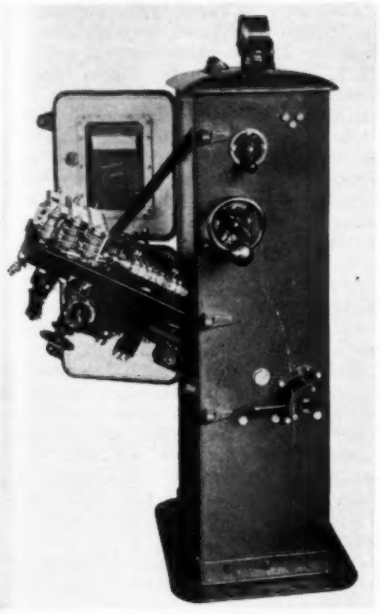
For ventilation purposes the *Queen Mary* is divided into sections corresponding to the Stone fireproof and water-tight divisions. In each of these is a Thermotank air-conditioning unit comprising a tubular air heater, an air humidifier, casing and a multi-vane fan driven by a Metrovick silent-running motor from which magnetic hum has been eliminated. There are 230 of these motors with an aggregate horse-power of 1,100; the length of ducting exceeds forty miles and the air dealt with is 118 million cu. ft. per hour.



Left: A portion of one of the radio transmitters (Int. Marine Radio Co.). Right: Salinometer for turbo-generator condensers (W. Crockatt & Sons)

In each cabin-class stateroom both warm and cool air are on tap, and in the public rooms Thermotank distributors fitted flush with the ceiling secure freedom from draught. In the tourist lounge, which is used as a cinema, the temperature of the air is automatically controlled and the supply is completely changed every two and a half minutes. In the kitchen the change is every three-quarters of a minute.

Engine-room ventilation is on a separate Thermotank system and nineteen Metrovick motors (336 h.p. in all) are in

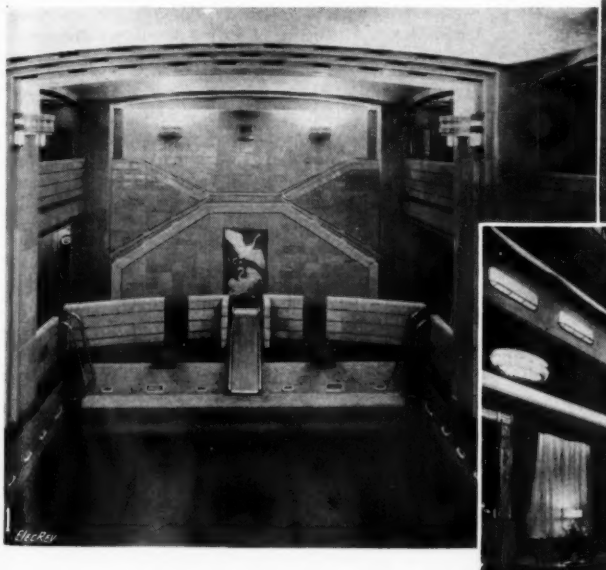


Allen West control pillar with hinged interior

use for this service. For creating any "climate" required in the public rooms, air-conditioning plant has been installed by the Carrier Engineering Co., associated with which are seventeen Metrovick marine type motors (100 h.p. total). Smaller motors of the same type are use for driving various exercising apparatus in the gymnasium supplied by Spencer, Heath & George, Ltd.

Every type of accommodation has its own service of lifts, twenty-one having been provided by Waygood Otis, Ltd. Twenty of these are of the two-speed self-levelling type of identical pattern travelling at 200 ft. per minute and they can be operated from the emergency supply if necessary. The greatest rise is 70 ft. 9¾ in. for conveying passengers and mails to the tourist promenade decks.

The deck winches provide an excellent example of electrical gear that is integral with its load, the motor and controls being built into the machine carcase. There are fifteen of these, all of the Metrovick-Clyde worm-geared type. Six are capable of lifting two tons of cargo at 290 ft. per min. or six tons at 125 ft. per min., and three of lifting one ton of mails and baggage at 300 ft. per min. Six are gangway



1. Swimming bath lighting. 2. The tourist dining saloon. 3. Cabin class lounge

winches with duties of three tons at 40 ft. or one and a half tons at 80 ft. per min. A magnetic brake is released when the motor is switched on and comes into operation on switching off. The motors are compound-wound, the shunt field being sufficient to prevent racing on light loads. A pendulum time-delay device on the control gear of the cargo and luggage winches prevents too rapid an acceleration. There are also twenty-four lifeboat winches driven by 20-h.p. motors, which with their controllers and numerous small auxiliary motors were supplied by the B.T.H. Co.

Eight warping capstans and one warping winch driven by motors of an aggregate horse-power of close on 1,900 and supplied by Laurence, Scott & Electromotors, Ltd., have been installed chiefly for working the liner alongside the quay after making fast. Their speeds can be regulated down to zero by Ward-Leonard control as can that of the ten-ton 80-h.p. capstans. Other motors supplied by the same concern include three 250-h.p. motors for operating the steering gear and two of 292 h.p. for the anchor gear, the total coming to nearly two hundred machines (mostly of standard design) the output of which, together with the motor generators amounts to some 18,000 h.p. Included in these are eight of 285 h.p. for driving the main circulating pumps and eighteen with a total output of more than 3,400 h.p. for the forced-draught fans. Even food refrigeration requires over 100 h.p.

A large proportion of the motors installed in the ship are equipped with Ransomes & Marles ball and roller bearings.

Another interesting use of electricity is the sixteen-point salinometer outfit supplied by W. Crockatt & Sons, Ltd. One indicates the salt content of the water in the feed tanks by comparison with conditions at the outset of the voyage, an increase of 2 gr. causing a warning to be given. Another self-contained instrument, but with a range of 0—3 instead of 0—12 gr. relates to the discharge from an auxiliary condenser. Multi-point units test the state of the condensates from the turbo-generators and propulsion turbines.

The rudder requires steering gear exerting a torsional moment three times the power of any previously built in this country. The electro-hydraulic system with telemotor control of Brown Bros. & Co., Ltd., employs four cast-steel cylinders with rams coupled in pairs. The driving motors are fed from a switchboard equipped with automatic contactor starters and supplied from both main and emergency systems. The switch-

board is a product of Brookhirst Switchgear, Ltd., which supplied over 270 starters for various duties, including those for more than 250 fans as well as four low-power motor generators.

Motor-control gear of types to suit the varied working conditions has been provided by Allen West & Co., Ltd. Among this are some 130 equipments used in connection with the auxiliaries of the propulsion units and turbo-generators, the bridge, sewage, fire and water and oil-fuel pumps and the air-conditioning plant and generating room fans. The largest and most elaborate are those for the eight 285-h.p. circulating pumps which have a speed range of from 280 to 480 r.p.m. Contactor-type starters (with which the field regulators are interlocked) in open switchboard form are mounted in pairs in rooms adjacent to the engine rooms and operated by push-buttons near the pumps. Rate of acceleration is governed by a magnetic drag, adjusted to suit the load, which controls the resistance short-circuiting relay. For other machines hand-operated drum controllers are employed with two s.p. contactors on which all current is ruptured.

Steering is done automatically by means of the Sperry "Gyro-pilot." One unit which is mounted on the bridge detects changes of course and determines the requisite rudder movement; the second comprises an electric motor for actuating the controls of the steering engine, magnetic-relay motor control, automatic clutch connecting the motor to the steering gear and an electrical transmitter for repeating the movements of the rudder back to the bridge unit.

A "Gyro-compass" gives true north readings without computation, the earth's rotation causing the axis of a high-speed wheel to take up a position in the plane of the meridian; its indications are electrically transmitted to repeater compasses. The Sperry Gyroscope Co., Ltd., has also supplied two pedestal-mounted arc searchlights, the drums of which are single-piece castings offering rigid support to the parabolic ground-glass mirrors; to it are fitted 55-A automatic third-electrode lamps giving 25 million beam candle-power each.

The recording "Fathometer" made by the Submarine Signal Co. (London), Ltd., gives visual indications of depths up to 130 fathoms at the rate of fifty soundings per minute. A neon lamp shows a red flash on a dial and at the same time a rotating stylus marks the appropriate point on a graph, thus providing a contour of the sea bottom. Submarine signal receiving apparatus, including distance-finding gear, has been supplied by the same concern for ascertaining the direction and distance of light-vessels or shore stations from one signalling source.

The telephone equipment on the *Queen Mary*, which is of the General Electric Co.'s manufacture, comprises a three-section switchboard with accommodation for 650 lines (ten of which can be connected to shore exchanges of any type while in port) and forty-seven cord, three ringing and three telephone circuits. The system will be used largely for hotel service, the calling passenger being plugged through to the steward attending his group of cabins, which can be varied by coupling arrangements on the main switchboard. When at sea all cabins can be plugged through for radio service to the shore. The instruments incorporate hand micro-telephones with the "Gecophone" anti-side-tone circuit. A separate telephone system is installed between the kitchen-clerks' office and the pantries on the various decks. The whole of the equipment is operated from two sets of 12 Planté-type accumulators controlled through a "Sindanyo" panel switchboard. A dynamotor operated from the 24-V exchange battery, with an output of 2.5 W at 75 V, 24 cycles, supplies ringing current to the various extensions.

A system of electric telegraphs by Siemens Bros. & Co., Ltd., controls each of the four 20-ft. dia. Stone bronze propellers from the bridge, the operation of the boiler houses and generator rooms from the engine rooms and gives instructions for docking, steering and anchoring. There are also Siemens revolution indicators controlled by magneto generators driven by the propeller shafts, electric thermometers in the provision chambers connected to a central indicating instrument in the refrigerating engine room, CO_2 indicators on each of the twenty-four main boilers and torsion meters for measuring the horse-power transmitted by the propeller shafts.

For audible communication the "Loudaphone" system, supplied by Clifford & Snell, Ltd., is in use. Attention is attracted by audible as well as luminous signals. The double-acting transmitters are of sufficient power to enable speech to be heard under noisy conditions. Speech reception in machinery spaces on deck is by the dual operation of a reed-controlled loud-speaker and an earphone. There are altogether thirty-four lines, many of them arranged as independent two-way circuits, the others being provided with selector switches and lamp indicators.

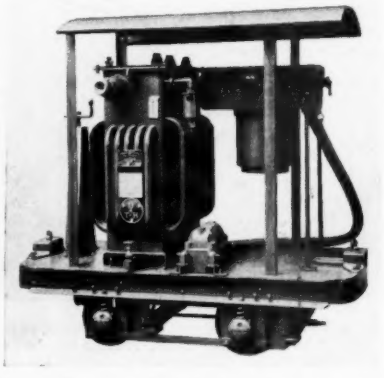
The radio installation was supplied by the International Marine Radio Co. and is designed for automatic multiplex working; with all four transmitters and receivers operating simultaneously it could handle telegrams at the rate of thirty per minute. The long-wave, continuous-wave transmitter has a range of from 1,875 to 2,725 m. and seven pre-determined and spot waves; the medium-wave, continuous and modulated continuous waves, covers 600 to 800 m. and has four pre-determined and spot waves; two short-wave (c.w. and m.c.w.) and telephony transmitters (c.w. and m.c.w.) have a range of from 17 to 96 m., each with ten crystal-controlled spot waves. Wave changes from one spot wave to another can be effected in three to five seconds by remote dial control 400 ft. away.

A radio-telephone service is provided through either of the short-wave transmitters between the occupant of any of the 500 cabins and a telephone subscriber in almost any part of the world; secrecy is secured through the incorporation of "speech-jumbling" devices. Power is provided by a special duplicate generating plant. An emergency transmitting and receiving equipment, with a range of 500 miles, is operated from an accumulator. "Brimar" valves made by Standard Telephone & Cables, Ltd., are used in the receiving sets in various parts of the vessel.

Finally, everything appears to have been done to eliminate fire risk. Provision is made for heat from high-wattage lighting fittings to be extracted through the exhaust ventilation system. Wires of different polarity and voltage are kept as far apart as practicable. In weather decks, working spaces, store-rooms and the crew's quarters, the wiring is carried in steel conduit. In passenger accommodation and public rooms the wires are run in grooved casings of impregnated timber arranged on the surface of the panelling, but behind ceilings or panelling conduit is used.

A Portable Transformer Sub-station

THE provision of a low-voltage power supply in quarries or similar workings normally provided with light railway tracks presents an opening for a simple step-down mobile sub-station. This permits of distribution at a comparatively high voltage, the l.v. supply being tapped off where required, thus avoiding the heavy cost of l.v. distribution over an extensive area. The unit illustrated was recently constructed by the British Thomson-Houston Company, Ltd., for the New Consolidated Gold Fields in West Africa. It consists of a 60-kVA, three-phase, 50-cycle, oil-immersed, self-cooled, outdoor-type transformer for stepping down from 3,300 to 440 V, and provided with ±2½ per cent. and 5 per cent. tappings on the h.v. side, externally operated tapping switches and calcium chloride breather. A 100-A, 50,000-kVA oil circuit-breaker is mounted on a special pocket on the transformer tank; the connections between the transformer and circuit-breaker are totally enclosed. The breaker is provided with three overload trips and an integral device that enables the tank to be lowered for inspection without dismantling the equipment. The h.v. cable entry is by means of a compound-filled sealing chamber in the body of the breaker, armour clamps and earthing arrangements being provided to accommodate a heavily armoured flexible cable which leads to a link box mounted on the truck platform. The cable bringing the h.v. supply to the truck from the tapping point terminates in a similar box connected to the other by links and under the same cover. The l.v. transformer terminals are brought to a four-pin plug and socket of the weatherproof mining type. The whole equipment is mounted on a four-wheeled bogie provided with a steel-plate deck, a screw-down hand-brake which operates on all wheels and couplers for haulage. A steel canopy affords some protection from tropical sun and rain and from falls of stone in the workings. The electrical equipment is entirely enclosed; each piece of apparatus is solidly connected to the truck frame by heavy copper strip, and an earthing plate and length of bare stranded copper are provided.



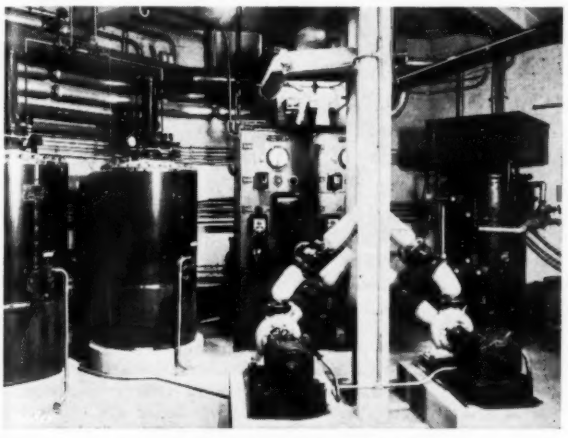
A B.T.H. portable, 60 kVA transformer sub-station

More All-electric Flats

Three installations of particular interest

THE popularity of the all-electric flat is to-day so widespread that many of our readers will probably appreciate a further indication of the trend of modern installation practice. From the multitude of new buildings recently completed in London we have selected as examples three which are of particular interest electrically.

Probably the most noteworthy feature of Chesil Court, Cheyne Gardens, Chelsea, is the electric thermal-storage system which has been designed and installed by Messrs. Rosser & Russell, Ltd., under the supervision of the Chelsea Electricity Supply Co., Ltd. Two Bastian & Allen 400-kW electrode boilers are employed to heat the water for storage in six 2,500-gal. cylinders, two of which are for the domestic hot-water supply and the remainder for the central heating installation. The water is softened in a "Boby Azed" equipment, and both the primary and secondary pumping is done by Bull "Super-silent" pumps. Thermostats are fitted on the boilers and on all the storage tanks, and the storage temperature of 240 deg. F. is reduced to the flow temperature of 100 deg. F. by means of a Rosser & Russell mixing valve. The plant is fully insulated, all high temperature vessels and mains being covered with 3 in. of cork.



The electric thermal storage boilers, control panel, and water softener at Chesil Court, Chelsea

The building adjoins the Chelsea Electricity Supply Co.'s Alpha Place distributing station in Flood Street, where the 6,600-V, three-phase supply is stepped down by means of Hackbridge transformers to a pressure of 400 V before it is introduced into the electrode boiler. The use of the supply is restricted to the hours of 9 p.m. to 9 a.m. and, although the time-switch and control gear is situated in the boiler-room of Chesil Court, the Chelsea Electricity Supply Co. has made arrangements (similar to those for Messrs. Peter Jones' premises in Sloane Square described in our issue of August 16th, 1935, page 211), by means of a pilot cable and a switch panel installed in the machine room of its Alpha Place station, to enable it to take over the control and regulation of the load should it wish to do so.

Invisibly embedded panel heating has been installed throughout the flats, this being particularly suitable for electric thermal storage owing to its economy in operation and the low circulation temperature employed. In the bathrooms the mirrors are kept free from steam by low temperature panels installed behind them.

With regard to the other electrical services of Chesil Court, Messrs. Rashleigh Phipps & Co., Ltd., the electrical contractors, have installed lighting and power points on a liberal scale in each of the living rooms, and Belling inset fires are incorporated on each side of the fireplaces, permitting the use of coal fire in each flat if desired. Lights are provided in the built-in wardrobes in the bedrooms. The kitchen equipment includes a Jackson cooker, an Electrolux electric refrigerator, and a specially designed drying cupboard. The bathrooms have electrically heated towel rails controlled by pilot lamp switch-sockets. Telephones for communication with the hall porter are provided, and Gent's electric clocks are installed in the entrance hall of each flat. Radio relay services are provided throughout the flats by British Relay Wireless, Ltd. The lighting fittings were supplied by the S.L.R. Electric, Ltd.

No gas mains have been run in a new block of flats, the first of three to be erected on the Warren House Estate, Valencia Road, Stanmore. The North Metropolitan Electric Power Supply Co., which carried out the electrical installation, has an all-in rate consisting of a fixed charge of 13s. 2d. per quarter for each flat plus ½d. per kWh, and the owners are considering paying the fixed charge so that the only direct payment by the tenants would be the "unit" charge.

To provide for the extensive electrical installation, two four-core 0.05-in. service cables feed each block and terminate in a space underneath the halls, access being by means of trap doors. Each service supplies four flats. The rising mains consist of 19/0.444 v.i.r. cables run in screwed conduit, and they terminate in cupboards in the kitchens. Here the meters are fixed and the cut-out is sealed by the supply company.

Fifteen lighting points are provided in each flat, with three 5-A M.K. "anti-flash" flush sockets for radio and small appliances. Plain pendants are employed except in the kitchens and bathrooms and lavatories, where enclosed units have been installed. Venner time switches control the hall and staircase lighting, but in order that the staircase lighting may be used late at night, Falk Stadelmann time-lagged switches, set to operate from one to three minutes, are provided. The lighting of the garages is also controlled by time switches. Power points are located in the dining room, living room, three bedrooms and the kitchen. Berry's "Flecta" fires are fitted in

Views of the Warren House Estate flats, Stanmore, showing the exterior, a kitchen, a living room and a bedroom wash-basin with cupboard door underneath removed to reveal Sadia water heater

the bedrooms and dining room and are recessed in ornamental concrete surrounds.

Hotpoint cookers, supplied with Bulpitt 6-pint quick-boiling kettles, are available at from 8s. to 11s. per quarter, according to size, and for these, points have been provided with a 30-A double-pole main switch and fuses, together with an M.K. cooker control board with switchplug. A 2.2-cu. ft. B.T.H. "Liftop" refrigerator is also included in the kitchen equipment, and hot water from a 3-gal. Sadia water heater.

Jackson equipment is used in the all-electric kitchen at Stratford Court, Oxford Street, London

To supply hot water for the bathroom and two smaller bedrooms, 30-gal. galvanised tanks, fitted with 2-kW Hotpoint immersion heaters and "Satchwell" thermostats, have been fixed in each bathroom. These tanks are lagged with cork wool protected by "Insulwood" and finished with enamel to match the decorations. The wash basin in the remaining bedroom is served by a 1½-gal. Sadia water heater housed in a small cupboard under the basin.

A central all-electric kitchen is one of the interesting features of Stratford Court, a block of service flats just erected off Oxford Street, London, W.1. Among the equipment supplied by the Jackson Electric Stove Co., Ltd., are a large cooker, hot-cupboard, boiling pan, water boiler and fish fryer. Semi-indirect lighting fittings in a combination of pastel blue and red glass are to be seen in the restaurant, where several box-type fittings are also provided. In the entrance hall wall-brackets of oxidised bronze and glass have been designed by the General Electric Co., Ltd., to match the octagonal three-tier pendants: a "Magicoal" imitation coal fire also harmonising with the general decorative scheme.

A "Prestcold" cooker, hot-plates, grill and refrigerator are formed into one compact unit for use in the small kitchen in each of the flats. Although Berry's inset electric fires are installed in the living rooms, central heating is provided from a thermostatically controlled Sulzer boiler fitted with a Bastian & Allen automatic coal burner. To ventilate the kitchens and bathrooms there is a forced draught system operated by Keith & Blackman fans on the roof and controlled by Allen West direct-on starting switches in parallel on the roof and in the basement; a similar switch has also been installed in the main kitchen. Vacuum cleaning points all over the building are connected to a central Lamson plant equipped with an Electrical Apparatus Co.'s starter. The electrical installation was carried out by the Berkeley Electrical Engineering Co., Ltd., Messrs. Sulzer Bros. (London), Ltd., undertaking the heating and ventilating work. Most of the lighting fittings were supplied by Messrs. Frederick Thomas & Co., Ltd., and Messrs. Edward Trower & Co., Ltd.

Tariff Principles. By D. J. Bolton

Time characteristics of diversity and load factor

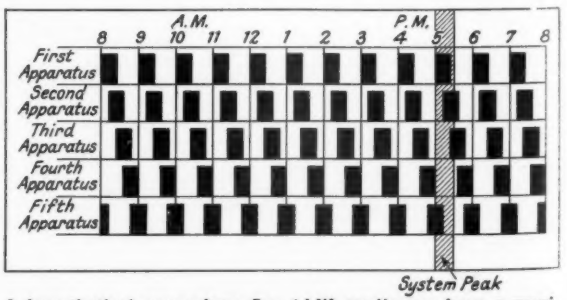
AN article that appeared in the ELECTRICAL REVIEW of April 17th, page 563, distinguished between individual and group diversity, and defined the former as the consumer's maximum demand in kilowatts divided by his kilowatts at the time of maximum demand on the system. It was shown that a theory of diversity is essentially a theory of probability and must assume many consumers connected to one point.

In order to understand the operation of diversity it is best to start with a purely fictitious and (what may appear) quite unlikely case. When this has been studied, the probable departure therefrom of actual conditions can be examined. The first step in the argument is to postulate a consumption (spread over a period) which is entirely without any specific time characteristic during the period. This means that it is just as likely to be on at any one minute as at any other. For example, a motor in a shop employing individual drive tools might be subject to use at any time during the factory working hours, say 8 to 12 and 1 to 5. During these hours it shows no partiality whatsoever for any particular time. It may be objected that such characteristics never occur in practice, since if they did, the effect of several consumptions of this kind would be to cause the total factory demand to be absolutely uniform—a very rare occurrence. But this objection overlooks the need for numbers, dealt with above. In order to obtain any approach to uniformity of load, there would have to be at least twenty and preferably fifty or a hundred of the same kind.

Domestic Examples

Other illustrations occur in domestic practice. It might be found, for instance, that an iron or a vacuum cleaner was liable to be used at any time from 8 a.m. to 8 p.m., and that, taking some hundreds of households, there was no tendency for it to be used at any one time more than at any other. A thermostatically controlled space-heating load might also, if climatical fluctuations are ignored, be regarded as another possible example; and if there were a sufficient number of them, the precise time of cut-in and cut-out of any one might be regarded as a matter of pure chance. Even a water heating load, although inevitably biased towards certain times of day by the habits of the household, may approximate to the required characteristics when sufficient households are included. This may be illustrated, for simplicity, by some appliance the loading of which does not vary during use, *e.g.*, a domestic piece of apparatus or a works motor driving at constant torque.

Supposing that, as between one house and another or one factory and another, the appliance is liable to be used at any time from 8 a.m. to 8 p.m. The true load factor (*i.e.*, over the 24 hours) is 20 per cent., so that the load factor during the use period is 40 per cent. Supposing, also, that the use of the appliance shows absolutely no time differentiation, *i.e.*, that it is used indiscriminately at all times during the period. In the first place, assume five such appliances of 1 kW loading, each one used for 24 minutes and then disused for thirty-six minutes every hour. These uses are perfectly regular and perfectly spaced as between the different appliances. This case is illustrated in the accompanying diagram, where the first



A hypothetical case where five 1-kW appliances have a maximum demand of 2-kW

appliance starts at 8.0, 9.0, 10.0, &c., the second at 8.12, 9.12, 10.12, &c., the third at 8.24, 9.24, and so on. The result is that at all times two and only two appliances will be on at once. The maximum demand on the system (represented by the overlap on the shaded belt) will be 2 kW, since this is the constant aggregate load throughout the period.

If, instead of being used twenty-four minutes every hour they are used twenty-four seconds each minute the result will be exactly the same provided the spacing is again uniform and symmetrical. Once again it only requires five appliances

in order to provide a constant 2-kW load on the system, The diversity factor as before is 5/2=2½. So exact a symmetrical spacing would not happen in practice, but that only affects the number of appliances required, not the general principle. Provided there are sufficient of them and provided they have undifferentiated time characteristics the results will be approximately as described, whatever the spacing, for the meaning of this characteristic is that there is no more likelihood of the appliance being in use at one moment than at another. In the present case the load factor during the use period is 40 per cent., so that at any instant there is exactly a four-tenths chance of any one of them being on. If there are a hundred appliances there will be approximately forty in use and sixty out of use at any one moment.

The (proportional) closeness of the facts to this mathematical statement will then depend on the number of similar appliances connected. If there are only a dozen or so, the non-symmetrical spacing will affect the results, and the actual maximum demand in the metered period may be either more or less than that calculated above, but if there were five million of them it could be stated with confidence that, however, erratic the spacing, the m.d. would be two million kW.

If the loading fluctuates during use, instead of being of the "on or off" character, the same thing is true. Provided there are sufficient appliances of spasmodic time characteristics the m.d. will be the sum of the mean loads during the use period, and the diversity factor will be the reciprocal of the load factor during this period.

Results and Divergencies

The surprising fact emerges that with the above hypotheses the load factor during the use period has no effect on the true maximum demand on the system although it directly affects the metered m.d. of the consumer. If it is a factory load that is under consideration and if the factories work eight hours a day (and the same eight hours) the effective load factor will be 8/24=33⅓ per cent., and such consumers can be given the benefit of such an assumption. To make the case more specific, let the maximum power be 100 kW and the annual energy consumption be 146,000 kWh. The true load factor is $\frac{146{,}000}{100\times8760}=\frac{1}{6}$, but this is due to the combined effect of a connection-hours load factor of ⅓ and a load factor during connection of ½. From the point of view of supply costs, the load factor during connection is immaterial and can be regarded as unity. The effective load factor (for supply costs) is therefore ⅓, and the effective m.d. is only 50 kW.

In a similar way, if it is a domestic load that is under consideration, and if this may occur at any time indiscriminately between 6 a.m. and 10 p.m., the effective load factor will be 16/24=⅔, or 67 per cent. In order to achieve these results, however, two things are necessary, neither of which will ever be fully realised. There must be a sufficient number of similar loads for the law of averages to operate fairly well, and they must have purely undifferentiated time characteristics. As regards the former requirement, probably at the power station, the bulk supply point, or even at a main sub-station the numbers will be sufficient. But in assessing distribution costs the numbers at any one distribution point may be too few to obtain even an approximate agreement with the theory. The second requirement will be harder to realise.

Any attempt at assessing time characteristics is necessarily tentative. Probably a factory power load will show the least deviation from the above requirements. If the consumption for lighting and heating is separated off, the remainder may well show a very fair approximation to undifferentiated time characteristics. The effective load factor on the system will then be only slightly lower than the hours load factor, *i.e.*, working hours per diem÷24. But the working hours must be taken as those common to all the factories in the area concerned. Thus, if the normal working day is eight hours, unless all factories start and stop together the use period may range over ten hours of the day of which only six are common to all. The probability of demand during the fringing hours will be less than during the common period so that it would not be correct to estimate the effective load factor from 10/24.

Taking next the domestic non-lighting load, this will be fairly well undifferentiated in the case of irons and cleaners, less so with water heaters and still less so with cookers unless of the thermal-storage type. The full use period may be from 8 a.m. to 8 p.m. with a "fringing" period of several hours on the outside of each time. During these periods the probability will be less but not zero. By combining these loads a better approach may be obtained to undifferentiated characteristics. Cookers and cleaners may to some extent dovetail even within a single household, but for the most part one must rely on large numbers of adjacent consumers to provide the diversity. In the case of space heating appliances, similar remarks apply except that the regular use period might be, say, from 8 a.m. to 10 p.m. during four or five months of the year only. The value of L will be correspondingly reduced, but the use within these hours may be fairly undifferentiated.

For the lighting load, this cannot be regarded as even approximately undifferentiated, since it is largely a function of darkness, and this occurs at about the same time throughout the country. The load therefore gravitates to particular hours of the day and year, so that the spasmodic character necessary for probability principles to operate is not present.

In all the above cases it is assumed that the use period fully overlaps the particular half-hour during which the m.d. of the system occurs. If it does not overlap, the effective m.d. on the system will be zero, and if it only partially overlaps, the m.d. will be reduced in a corresponding ratio.

The results may be summed up as follows:—Bad load factors during the use period are to a greater or less extent compensated for by diversity factor. When the use has no specific time characteristics within the period, this compensation will be complete wthin the accuracy of the ordinary law of probability. In general, if L is the fraction—daily use period in hours divided by 24, and F is the load factor during the use period, the true load factor is the product L.F. The diversity due to spasmodic use during the period may be empirically expressed as $\left(\frac{1}{F}\right)^n$ where n is a constant less than unity. The effective load factor on this system will then be $LF^{(1-n)}$.

It is preferable to deal with the day rather than the week, *i.e.*, to speak of a factory day of eight hours rather than a week of forty-eight hours. It is true that the former gives the consumer the benefit of a better "hours" load factor than he appears to be entitled to, since 8/24=33 per cent., whereas $\frac{48}{7\times24}=28.5$ per cent. But it may be taken for granted that the m.d. on the system if it occurs within the factory hours at all will do so on a full week day (Monday to Friday). The effective load factor will therefore be $F^{(1-n)}$ multiplied by 33 per cent. rather than 28.5 per cent. This, of course, assumes that the system peak has an equal probability of occurring on a Saturday or Sunday. If there is no chance of its occurring then the above value for L would have to be multiplied by 5/7.

The value of the index n would approach unity with a large number of appliances connected having entirely undifferentiated time characteristics. It might be from 0.6 to 0.8 for a power load, and 0.4 to 0.7 for a non-lighting domestic load.

Loads having a predilection *away* from the peak period are less likely, since the peak period is by definition the time when most people are using electricity, and, therefore, when it is generally most useful. But if this time occurs in the afternoon there will be some loads having a preference for the morning (*e.g.*, vacuum cleaners), and if it occurs in the week-day there may be some which excel on Sundays (*e.g.*, cooking). The result would be a system diversity greater than $\frac{1}{F}$—*i.e.*, n greater than unity. It would be unsafe, however, to presume on this, particularly as conditions may change and hollows may become peaks. There is also the danger of localised peaks developing even when the system as a whole is well diversified. It is, therefore, better to leave any possibility of favourable discrimination to serve as an occasional bit of luck and to legislate on the assumption that the best condition to be met with is complete indiscrimination.

Anything so tentative as the theory here outlined can hardly be said to be susceptible of "verification," and would in any case require far more data than is at present available. The utmost that can be done is to show that it is generally consistent with observed facts and current practice in tariff fixing. In the American tests relating to water-heaters referred to in the previous article, fourteen groups of heaters were taken, having eight to sixty-six in each group. In each case the diversity factor for the whole group was obtained and also the mean weekly load factor of the individual heater. By plotting the logarithms of these values it was found that they could be represented very closely by an index of $n = 0.5$ and a value of $L = 0.54$, *i.e.*, a use period of $0.54 \times 24 = 13$ hr.

These results are in accordance with common sense as well as with the present theory. They suggest that the full use period is 13 hours a day, *e.g.*, from 8 a.m. to 9 p.m. That within this period the use is only partially undifferentiated, the diversity factor being the square root of the reciprocal of the load factor during that period. Since this diversity refers to a group of loads of the same kind, it may be expected that the individual diversity of a single load relative to a whole system would show an appreciably higher value for this index.

In the article by Mr. Naylor, referred to in my earlier article, a curve of diversity factor was plotted to a base of load factor. This was interpreted by the formula $\left(\frac{1}{LF}\right)^{\frac{1}{2}}$, but it is much closer to $\left(\frac{1}{F}\right)^n$ where n has a higher value, as suggested above.

The Status of the Meter Engineer

By Oliver Howarth, M.I.E.E., M.Amer.I.E.E.

THIS subject has recently been discussed in the "Correspondence" columns of the ELECTRICAL REVIEW. In approaching the subject it is necessary first of all to define what is meant by a meter engineer. In this article I shall assume him to be an electrical engineer with the qualifications necessary for a graduate of the I.E.E., who has made a special study of electrical measurements, and is engaged in meter work in a supply undertaking. My reason for excluding meter engineers engaged in manufacture is that the correspondence has related to the status of the meter engineer in the supply industry.

Electrical engineers, like members of other professions, may be classified in two groups, which, for convenience, I will call class A and class B. All qualified engineers have had a sound technical training and sufficient practical training to enable them to apply their technical knowledge. The class B man settles down into a job with the feeling that, having obtained the necessary qualifications, and the job, he has arrived, and his struggle is ended. He continues to gain experience as the years go by (that is inevitable if he does his job), and a certain amount of new technical knowledge will be forcibly fed into him as he carries out his duties. If such a man is employed by a stagnant concern he will probably continue to do his job quite efficiently, and the relative status of himself and his colleagues will tend to remain fixed. If, however, he is employed by a progressive and growing concern he will probably get left behind by his more progressive colleagues, and he will either cheerfully resign himself to the inevitable or he will get disgruntled.

The class A man has a different outlook. Realising that new knowledge is continually being acquired by the scientist and passed into circulation for the use of the engineer, he sets himself out to acquire some of it as it comes along, more particularly that which bears upon his own sphere. Nor does he confine his attention to technical knowledge. By roaming over a wider field he is able to gain knowledge and experience which will be of use to him in carrying out the non-technical part of his work, and will help him to understand, and co-operate with, his colleagues. The class A man is thus always ahead of his job and can reasonably expect to make progress at least equal to the progress made by his undertaking.

In spite of the fact that meters are quite small, and do not require a gang of men or a crane to handle them, it is necessary for a meter engineer to have a full quota of knowledge and skill if he is to do his job properly. The meter department of a supply undertaking, if it is efficiently conducted, will be run quite differently from any other department. It is, in certain respects, like a manufactory. The staff must combine the outlook of the factory engineer with that of the supply engineer. The department must be organised to give the maximum output with the minimum effort and a high regard must always be paid to accuracy.

The work of testing may seem simple to an onlooker—just taking readings with instruments and stop watches, but those with experience know that considerable skill must be acquired before readings can be taken quickly *and accurately*. It is essential that the meter engineer's technical knowledge should be thorough and mathematically accurate. A superficial acquaintance with vectors, etc., is not enough, it will not enable him to state the requirements of correct metering for the types of supply which may be met with in almost any undertaking to-day. Technical knowledge alone is not enough, he must acquire skill at least equal to that of a tradesman to enable him to successfully handle the apparatus he deals with and the instruments he uses. If he is to rise to a senior position he must be a capable organiser and administrator, and he must continually be on the look out for more accurate and cheaper methods of making measurements—which compels him to keep abreast of technical developments—if he is to maintain the efficiency and ensure the progress of his department. In other words he must be a class A man.

What are his prospects if he does all this? That, of course, depends to a large extent upon his chief. There are wise chiefs who recognise the exacting requirements of meter work, if it is to be properly carried out, and they give their meter engineers every encouragement. The meter department becomes a testing department, and may extend its duties still further, so that the purely meter work is dealt with by one of a number of sections of a department. Nor does a wise chief expect a class A meter engineer to remain satisfied with less remuneration than a class B engineer with less important duties in some other department.

There are, unfortunately, chiefs who make the meter work a section of some other department, the head of which knows little or nothing about meters except, perhaps, how to enjoy the visit of a salesman, who contrives to sell meters to him which destroy the peace of mind of the meter engineer. Fortunately, such an attitude is dying out, perhaps because this kind of policy—which influences the whole of the organisation and not only the meter department—does not make for progress.

To sum up: If the meter engineer has the qualifications necessary for a graduate of the I.E.E., and is a class A engineer, and has a class A chief, the latter will see that the former has an appropriate grade without waiting for a push from the E.P.E.A. But (dare I whisper it?) there are some class B chiefs, and a class A meter engineer under a class B chief is as much likely to be regarded as a nuisance as an asset to the undertaking which he serves.

Meter engineers, as well as some of their chiefs, do not always realise that sound technical knowledge is only one—though an indispensable one—of the qualifications necessary for a meter engineer in a senior position. Organising ability, some acquaintance with the economics of electricity supply and the uses to which electricity is put, a sufficient knowledge of men and affairs to enable him to work harmoniously with his colleagues in his own and other departments, and ability to foresee the future trend in his undertaking and department are all essential qualities.

Meter engineers frequently complain that there is no specified grade in the N.J.B. Schedule for them. On the other hand, charge engineers complain that Grade 8, which is specified for them, is too low. Until such time as the duties and responsibilities of meter superintendents and other meter engineers become as consistent as those of charge engineers it is doubtful if any advantage will accrue from the inclusion of definite grades in the schedule for them. As meter departments are tending to grow in relative importance it is advantageous for meter engineers to enhance the reputation of their branch of the profession by the ability with which they carry out their duties and adapt themselves to the rapidly changing conditions in the supply industry, thus ensuring that the grades, when specified, will not be too low.

The Edinburgh Programme

FURTHER details relating to the Edinburgh Convention of the Incorporated Municipal Electrical Association are available in the official programme which has just been circulated to members.

Convention badges will be issued at the Convention Office, Usher Hall, Grindlay Street, between 10 a.m. and 1 p.m. and between 2.30 and 8 p.m. on Monday, June 8th, the opening of the Electrical Exhibition by the Rt. Hon. Lord Salvesen taking place at 3 p.m. In the evening the President of the Association, Mr. E. Seddon, and Mrs. Seddon will hold a reception and ball at the Assembly Rooms, George Street.

On Tuesday morning the Convention proceedings will be opened by the Rt. Hon. L. S. Gumley, Lord Provost of Edinburgh, and following the presidential address Mr. G. H. Lake (Nottingham) will read a paper on "Electric Water Heating." The afternoon will be taken up by visits to the Portobello power station and Messrs. Bruce Peebles's works. The Lord Provost's reception and ball are in the evening. Visits to the Rannoch and Tummel hydro-electric generating stations will occupy the whole of the next day (Wednesday). A special train will take members to Pitlochry and from there motor coaches will convey the party to Kinloch Rannoch *via* some of the works of the Grampian Electric Supply Co. After lunch a visit will be paid to the Rannoch hydro-electric station, and after tea the return journey will be made from Pitlochry, the special train arriving back in Edinburgh at 9.50 p.m.

"Large Scale Electric Cooking" is the title of a paper to be read by Mr. W. E. Swale (Manchester Electricity Department) and Mr. S. C. Hurry (Jackson Electric Stove Co., Ltd.) on Thursday morning. At 1 p.m. at the North British Station Hotel Mr. E. E. Hoadley (past president) will address the Edinburgh Rotary Club on "Modern Aspects of Electricity Supply," while at the same hour the Electrical Association for Women has arranged a luncheon at the Assembly Rooms, followed by a visit to the Zoological Park. During the afternoon Mr. P. J. Robinson (Liverpool city electrical engineer) is to read a paper on "Electric Street Lighting." The annual banquet and ball take place in the evening.

The agenda of the annual general meeting to be held on Friday morning includes a resolution referring to the forty-hour week. Motor coaches will convey delegates to Queensferry and Lauriston Castle in the afternoon.

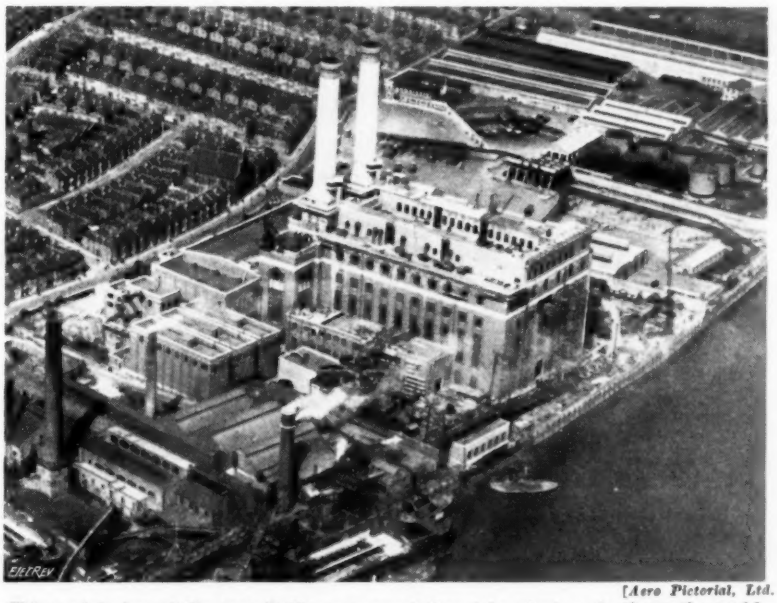
Electricity Supply Data

The latest engineering and financial statistics of the Electricity Commissioners

THE new volume (No. XI) of the "Return of Engineering and Financial Statistics relating to Authorised Undertakings in Great Britain" issued by the Electricity Commission, covers the twelve months ended March 31st, 1934, for public authorities and December 31st, 1933, for companies (Stationery Office 15s.). It also contains certain particulars of the operations of the Central Electricity Board during the same period.

In general form the Return follows its predecessors and is divided into two parts dealing first with the engineering and secondly with the financial particulars of each undertaking in alphabetical order, the statistics relating to municipalities and joint boards in England and Wales and in Scotland, being followed by those for companies and Joint Electricity Authorities. There are also summary tables and a general review of the situation. Later information on some aspects (*e.g.*, kWh generated and sold, plant installed, fuel consumed) is now available from the fifteenth annual Report of the Electricity Commissioners (1934-35), the eighth annual report of the Central Electricity Board (1935) and the Fuel Returns (1935) which were reviewed on March 6th, April 3rd and April 24th.

The number of separate undertakings giving supplies in 1933-34 was 643 (376 public authority). The 13,915 million kWh generated was produced in 437 stations with an installed capacity of 7,837,000 kW, of which three-fifths was in the 236 stations of public authorities. Steam-turbines formed 95.87 per cent. of the prime movers and alternators 94.6 per cent. of the generator kW capacity, nearly two-thirds of which was composed of units of 10,000 kW or more.



[*Aero Pictorial, Ltd.*

This aerial view of the new Fulham power station, taken last week, shows the rapid progress which has been made in its construction

The proportion of plant of non-standard frequency is being rapidly reduced, but two years ago it was less than one-tenth of the rating of the a.c. machines. Boilers with an hourly evaporation capacity of 30,000 lb. amounted to more than 81 per cent. of the total number and more than a third had a working pressure of 300 lb. per sq. in. or over.

Supplies were given at ten different frequencies by 282 undertakings distributing a.c. only and 283 distributing d.c. as well as a.c.; seventy-seven supplied d.c. only. The standard a.c. voltages of 400/230 were declared by 394 undertakings, but there were also forty other voltages in use, between 100 and 480, three or more voltages being declared by 287 undertakings, four or more by 143, and five or more by 46 undertakings.

The percentages of the 11,467 million kWh sold for different purposes was 34.2 for lighting, heating and cooking, 55.7 for power, 1.9 for public lighting, and 8.2 for traction.

The 217 smallest undertakings were responsible for less than one per cent. of the total sales to consumers, while nine sold more than 200 million kWh each. The number of consumers was 6,110,000—an increase of 14.5 per cent. on the previous year, compared with the 12.3 per cent. increase in consumption. Load connected, exclusive of bulk supplies, totalled 16,200,000 kW. For every hundred kWh generated 5.73 was used in the works and 12.93 was lost in transmission and distribution.

The aggregate of the maximum loads on undertakings was 5,886,000 kW (inclusive of bulk supplies given) and on generating stations 4,802,032 kW. There were 283 undertakings with m.d.s of less than 1,000 kW and nine with m.d.s exceeding 100,000 kW. The ratio of kW installed to aggregate m.d. on generating stations showed a surplus plant capacity of 63 per cent. The combined load factor of undertakings was 33.1 per cent. ranging individually from 9.8 to 69.7 (Lochaber Power Co.).

Pulverised fuel was used by 22 undertakings, representing nearly fifteen per cent. of the total tonnage of coal burned. At 140 steam stations more than 1,000 kWh was generated per ton of fuel.

Expenditure charged to capital account at the end of 1933-34 was £425 million (£257 million by public authorities), omitting the £29 million spent on the grid and £12 million on frequency standardisation, which together increased the total for the whole supply industry to £466 million. The percentage of this total accounted for by generation was 31.35, by the grid 6.22, by other transmission systems at 33 kW and above 3.66, and by distribution 47.13. Other expenditure included apparatus on consumers' premises 5.08 per cent. and load frequency standardisation 2.54 per cent. Capital spent on generation represented an average of £18.6 per kW installed. The aggregate figure (including the C.E.B.) was £59.4 for all purposes, on which basis 2,460 kWh was sold per £100 invested.

Revenue from working, excluding sales of energy in bulk, amounted to £65 million. For the industry as a whole (including the C.E.B.) the revenue per £100 of capital corresponded to £14, and per kWh sold to consumers 1.26d. Allocated to various classes, this means that for lighting, heating and cooking (which provided 61.6 per cent. of the total revenue) the average was 2.28d., for power (32.4 per cent.) it was 0.73d., for public lighting (1.9 per cent.) 1.3d., and for traction (4.1 per cent.) 0.63d.

Working expenses (excluding capital charges) came out at £32 million or 0.664d. per kWh sold, again leaving out bulk supplies. This amounted to £6.8 per £100 of capital expended, including the grid, and absorbed 48.6 per cent. of the revenue. The generation and purchase of energy was responsible for about 38 per cent. and transmission and distribution for nearly 15 per cent. of the working expenses. Two-thirds of the cost of generation was due to fuel, for which the average prices were: coal 14s. 9d. per ton, fuel-oil 81s. per ton, and gas (mainly waste) 2.6d. per 1,000 cu. ft. Approximately 14 per cent. of the net working expenses (or 6.8 per cent. of the revenue, was paid as local rates. This was equivalent to £1.04 per £100 of capital. The gross surplus of £35.8 million represented 8.4 per cent. on the total capital expenditure. Public authorities paid 30.7 per cent. of their £21.5 million surplus in interest, 38.7 to loan repayments and sinking funds, 7.6 per cent. for reserve and renewals, 6.2 in income tax. Towards relief of rates, 105 undertakings contributed £635,000 and 16 were subsidised to the extent of £18,000, making a net allocation for the purpose of 2.9 per cent. of the total gross surplus, or £617,000.

Companies met interest charges with 17.6 per cent. of their £14.3 million surplus and paid 41.3 per cent. of it in dividends. Depreciation and reserve claimed 35 per cent. and income tax 1.25 per cent. The average dividend was 5.85 per cent. on preference shares and 6.96 per cent. on ordinary.

At the end of 1933-34, the capital on loan accounts of undertakings were overdrawn by £30,000, the balances in depreciation, reserve, renewal and sinking funds being £56.2 million and balances on revenue account £11.5 millions.

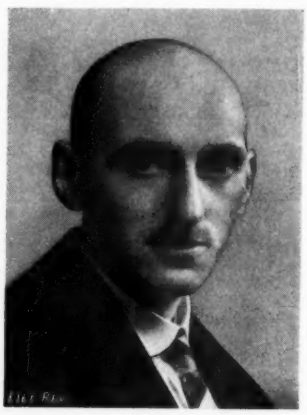
The 74,783 persons employed (4,400 more than in the previous year) received salaries aggregating £11,454,000. Those engaged in generation numbered 17,213, in distribution 41,724, and in administration 15,846, the average being nine for every 1,000 kW of generating plant installed.

Condenser Performance. By V. Walker, A.M.I.E.E.

Comparisons of methods of tube cleaning

As the performance of surface condensers involves a considerable number of variables the effectiveness of the different methods of tube cleaning will vary with the plant and local conditions. Those generally adopted are brushing by hand or by mechanical means; shooting rubber plugs by water or air through the tubes; hydrochloric acid solution; sand blasting through a special nozzle; pumping sand with the circulating water for an extended period; and treatment of circulating water by chlorine gas or chlorinated lime.

Where the time taken in cleaning need not be curtailed, brushing by hand is most effective, and three or four men can generally work on the condenser at the same time. Over an extended period this method may be superior to the shooting of rubber plugs through the tubes, as the plugs do not always clean close enough to the tube metal for the removal of all algæ growth. If scale is encountered, a metal scraper plug or small wire brushes are more suitable. As an air pressure of from 60 to 80 lb. per sq. in. is necessary to ensure that heavier plugs or brushes do not remain in the tubes, a screen, say of wire netting, must be arranged to prevent damage to the plugs through rebounding on the inner side of the condenser back door. Otherwise the latter must be taken off and a screen arranged outside the condenser. The plug method is quicker than cleaning by hand, by which the use of plugs is very often supplemented.



Mr. V. Walker is with the Bury Corporation Electricity Department

An occasional thorough drying out of the water side allows the accumulation of silt to be washed out and once the tubes are free from algæ propagation is less rapid. Drying out can be done quickly by removing a manhole door from each end of the condenser and circulating air through the tubes by means of a portable ventilating fan. Sand blasting through a special nozzle results in a thorough cleaning of the tubes, but I consider that the gain from such a procedure is insufficient to warrant the additional cost involved in the equipment. Cleaning by hydrochloric acid is not generally necessary, except where carbonate of sulphate scale occurs, and is probably limited to plants where cooling water is recirculated through a spray pond or the percentage of hard make-up water is large. Pumping sand with the circulating water for an extended period has sometimes given marked results.

Chemical Treatment

A number of operators use chlorine to inhibit fouling of the heat transfer surfaces where slime and algæ troubles are encountered. The chief advantage of the chemical treatment is the reduction of cleaning by mechanical means and generally higher average back pressures. The chlorinator equipment is operated to maintain residuals of 0.01 to 0.10 parts per 100,000 of chlorine in the circulating water at the condenser inlet. The length and frequency of the dosage is a matter of experiment. The amount of chlorine neutralised by river water increases with sewage contamination, as when a rapid thaw follows a large snowfall or when a river is frozen over, the latter causing a decrease in the oxygen content of the water. Chlorination equipment has been placed at the entrance to intake tunnels in order to deal with mussels and other marine growth, as well as with slime deposit in the condensers. It may be necessary, however, to blow out the tubes of the condenser with air periodically to remove mussel shell and other debris that may become lodged in them.

Condensers have been cleaned with hydrochloric acid solution, sometimes agitated by air, before using chlorinated water, as chlorine treatment does not clean a condenser already dirty, but maintains it thoroughly clean after treatment by acid.

In order to obtain flexibility in operation, equipment has been designed that will chlorinate a portion of the station circulation water at individual condensers, instead of at the common intake. At the junction of the chlorine-solution pipe and each point of application, a motor operated valve is installed, and different rates of chlorine application may be obtained automatically. Five or six different portions of the total circulating flow may be chlorinated at different concentrations for different lengths of time, and at different frequencies.

Sand in the circulating water has eroded the lower half of condenser tubes, while corrosion has occurred in the upper half, the area of corrosion apparently coinciding with the area on which slime accumulates. On the first six or eight inches at the inlet end of the tubes where slime has been kept scoured out either by turbulence or by sand, little or no evidence of corrosion is seen.

A theory has been advanced that the slime catches and holds foreign particles, resulting in a coating which is electrically negative with respect to the tube metal and causes transfer of the tube metals from the tube wall into the coating. Such slime corrosion is said to produce either local pitting or general thinning of the tubes, depending on whether the foreign material deposited in the slime is concentrated in spots or uniformly distributed.

Data collected by the Prime Movers Committee from various American power stations show that in American practice the tube life may vary from three years up to the life of the turbine. The periodic weighing of sample tubes appears to be the best method of checking tube life, but general renewals are required at considerably shorter intervals than might be deduced from such tests because of localised pitting.

Loss of Weight Comparison

Tests have been carried out on Admiralty brass tubes to ascertain if increased loss of tube material results from the chlorination of sea water, by observing the loss of weight of selected tubes in two similar condensers, one receiving intermittent chlorination for 1,400 service hours and the other supplied with unchlorinated sea water for 2,000 service hours.

From the loss of weight and operating time the percentage loss per year was computed. For the non-chlorinated tube this amounted to 5.5, and for the tube receiving chlorinated water 11.6, leaving a difference of about 6 per cent. per year which was charged to chlorination. Periodic checks show that the rate of loss due to chlorination continuously decreased; for instance, the loss of 11.6 per cent. per year after 2,000 service hours decreased to 5 per cent. per year after 8,000 service hours. This decrease was possibly due to the formation of a protecting coating which resisted the attack of chlorine. Tests on aluminium bronze tubes indicate longer life.

Plug dezincification of tubes in which local areas are affected, as shown by white spots visible on the tubes, does not weaken the tubes as much so general dezincification. Where dezincification is prominent in the upper row of tubes, an investigation of the circulating flow has shown that the condenser did not always remain full of water, the top row of tubes being frequently empty, due to air accumulation in the upper part of the water boxes, where the high temperatures probably aggravated the tendency towards dezincification. Where the circulating water, especially if sea water, contains sulphuretted hydrogen, the worst possible conditions exist for condensers containing brass or copper. The practice in some cases is to apply a coat of cement paint or a bitumastic solution at the inlet ends of the tubes to prevent corrosion. The cement may scale off, but reduces tube failures at the inlet ends. Small leaks in the tubes have been temporarily stopped by introducing sawdust into the circulating water through a booster pump, which takes water from the circulating system and discharges it into the condenser inlet through a cylinder containing sawdust. Another method, which requires less sawdust, is to employ steam injection to discharge the sawdust direct into the condenser inlet.

Many alloys are now available for condenser tubes which are superior to Admiralty and brass alloys. Copper-nickel alloy appears to be resistant to a wide variety of corrosive waters and aluminium-brass withstands impingement attacks.

Tube Packing

Tubes are generally packed at both plates with corset lace packing, although sometimes they are rolled into the tube sheet at one end and the other end is packed by metallic packing, which is, however, sensitive to tube vibration.

Air leaks on the steam side of the condenser can be measured directly by a flow indicator employing an orifice at the discharge of the air ejectors; this varies approximately from 1 to 5 cu. ft. of air per min. at 80 deg. F. Excessive air leakage can be detected by disconnecting the air pump from the condenser and observing the drop in vacuum. Leakage of the tubes and packing has been discovered by employing methylene blue as a dye for the water used to fill the steam space when testing condensers. Considerable improvement in condenser performance has been obtained by revision of the tube layout and baffling, an excessive depression of condensate temperature in winter being materially reduced.

Meetings and Discussions

Berlin Electricity Supply System

The Action of Lightning

Electricity Distribution in Berlin

BERLIN is the centre of many German industries, including the electrical manufacturing industry, and is rapidly growing in size. For electricity distribution purposes this large industrial area was at first treated as a single unit, but this plan was subsequently modified by experience. How this has been done by the Berliner Kraft & Licht (Bewag) A.G. is described in the paper by MR. M. W. H. DAVIES, which was read before the Transmission Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on May 13th.

Satellite towns, each with its own electricity supply system, have been combined to form Greater Berlin, now covering 360 sq. miles, with a population of just over four millions—about half the size and population of Greater London, the average density of population being almost the same in the two cases. The greater part of Berlin's population lives in flats, with the result that only 28 per cent. of the total area is fully developed. As the temperature there is below zero during the greater part of the winter, most people live in flats and houses equipped with steam central heating. To obtain a reasonable diversity factor for the domestic load it is therefore necessary to pay particular attention to the sale of cookers and water heaters.

A park separates old Berlin from Charlottenburg, each forming a separate load centre with a maximum load density of 56,000 kW per sq. mile. The average annual increase of load is just under 10 per cent. In 1934 the company sold 1,188 million kWh, its peak being 439,000 kW; the total consumption was 1,450.8 million kWh, or 345.8 kWh per head of the population. The "Bewag" system load factor was 36.2 per cent., and features of the load curve are the smallness of the mid-day valley and the size of the morning peak, due to the heavy traction load.

The bulk of the power is obtained from the 270,000 kW Klingenberg (east) and 224,000 kW Kraftwerk (west) stations, one of them maintaining the frequency by means of automatic relays. A large part of the base-load power is imported over 100-kV lines, terminating in sub-stations to the north and north-east. These lines transmit power from the Trattendorf and Zschornewitz stations on the lignite coal field in central Germany. Among a number of smaller and older stations which are kept in commission as reserves, that at Charlottenburg has been reconditioned and equipped with pass-out turbines connected to the public heating system, together with Ruths steam accumulators that can deliver 73,000 kWh per charge at a maximum rate of 50,000 kVA. The total Bewag installed capacity is 800,950 kW (eight stations) plus 142,400 kW (three stations) obtainable from other sources.

For local government purposes Berlin is divided into twenty districts, and sixteen of them are supplied with electricity by the Bewag. Unification was gradual, starting with the pooling of generating resources and followed by common tariffs. Financial mergers only took place when opportunities occurred. The company is controlled by two managing directors, one a commercial expert and the other technical, on the principle of centralised control with decentralised area management. One of the great advantages of this method has been economy achieved through inter-area competition and limitation of size of district offices.

Early development was on the three-voltage group system (*i.e.*, 30-kV grid delivering through 6-kV radial feeders into a 380/220-V network) divided into groups so as to limit the effect of failure of any single group. When this system was completed a simpler two-voltage system was devised for areas of high load density. The costly distributing stations are discarded and the l.v. mains are fed direct by 30-kV cables from the power stations, the 6-kV system being retained only for bulk consumers. The capital cost and transmission losses are substantially lower than those of the three-voltage system, but it is necessary for the l.v. cables to be connected up in a series of grids (not economical unless the load density exceeds 2,800 kW per sq. mile), each grid being fed by a number of 30-kV cables, so that the failure of any one will hardly be noticeable.

It is also necessary to prevent the l.v. network feeding back into a faulty 30-kV cable. For this purpose an ordinary air-break switch is connected on the l.v. side of the transformers and arranged to trip whenever the main circuit breaker controlling the 30-kV cable opens, and to close when the transformer secondary voltage rises to normal. The success of the two-voltage system has led to plans for its extensive use in strengthening the existing system where the 6-kV network becomes inadequate and possibly also when the central district is changed over from d.c. to a.c.

Great stress is laid on continuity of supply. It is therefore proposed, as soon as the load reaches one million kW, to divide the system into sections, each with a peak load of 500,000 kW, by linking the generating stations with a 100-kV ring and dividing the existing 30-kV grid into two sections. The 380-V system will be divided into a series of grids covering from one to two sq. miles, each section of the l.v. grid to be supplied by at least six different cables. The suburban areas, in which the load density is below 2,800 kW per sq. mile, will be supplied from small unattended 30/6 kV sub-stations.

The protective methods employed are outlined by the author, who concludes that the economies effected by standardisation, especially of sub-station equipment, and by centralisation of management, did much to help the Bewag to weather the serious economic crisis of 1929.

* * *

The Effects of Lightning

AN address on "The Theory of Electrical Traces" was delivered at the ROYAL SOCIETY OF EDINBURGH on May 4th by PROF. STEFAN JELLINEK, director of electro-pathology at the University of Vienna. Lightning had been described as "hot" and "cold," said the Professor, because persons injured thereby were sometimes entirely free from any signs of burning. Hitherto all injuries caused by electricity, whether atmospheric or otherwise, were falsely assumed to be burns. As a result, needless amputations were carried out in the belief that they were necessary owing to the danger of septicæmia. The study of these injuries had shown that most of them not only were not burns, but, in addition, had a striking tendency to heal—a specific property which could not be without influence in medicine in the study of treatment of other injuries.

These traces of electricity on the human body had, in addition to this biological property, such a peculiarity in their appearance that they formed a class in themselves. The morphological feature of the wounds, which gave the impression of having been caused by some instrument, such as scissors, knife, borer, &c., found a parallel in the alterations in the clothing of the victims, and even on the tools which they were using.

Even the experienced investigator sometimes had difficulty in recognising whether such alterations were in fact caused by electricity or by an instrument. It was only possible to do so either by means of microscopical examination of the tissue elements or by finding perhaps a most minute point showing signs of heating. When one found on highly combustible material, *e.g.*, celluloid, perforations without scarcely a trace of heating, then one was forced to the conclusion that the primary effect of electricity was mechanical. It had been possible with a cinema camera to observe the working of this mechanical factor on protozoa: in a few seconds by means of ultra-short waves of a very weak electric field the beautifully shaped protozoa-cell became shapeless and was destroyed.

* * *

Coal Face Lighting

Improved methods of coal face lighting which have been introduced with successful results at the Norton Colliery, Stoke-on-Trent, were discussed on May 11th at the NORTH STAFFORDSHIRE INSTITUTE OF MINING ENGINEERS. At the previous meeting a paper on these improved methods had been read by Prof. T. DAVID JONES (Cardiff University) and Mr. T. C. MAYNARD (manager of the Norton Colliery) who stated that after four years' experience of the use of "M.L." electric lamps, operated by compressed air this method could be strongly recommended as sound, safe and economical. Mr. E. H. VALLIS, investigator for the Safety in Mines Research Committee of the North Staffordshire Institute, said he had seen two coal faces at the Norton Colliery illuminated by the methods described, and the results were excellent, for one could walk about near the coal faces without the aid of a hand lamp. Prof. Jones said neither he nor Mr. Maynard claimed that the electric lamps were equivalent to the general standard of factory lighting, but the illumination provided at the coal face was as good as that in a number of factories.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Earth Faults

Some days ago I received a telephone call from the proprietor of a local garage saying that the lights were showing unusual brilliancy, the tyre pump motor was racing at an excessive speed, and other apparatus was giving abnormal results. So armed with the necessary equipment, which included a high-grade rectifier-type moving-coil voltmeter by makers of repute, I went to his premises to investigate.

On arrival I found the supply to be single-phase with a voltage of 230 between phase and neutral, 400 V between phase and earth, and 230 V between neutral and earth, tested on the input side of the main switch-fuse. At the outgoing side of the switch the phase-to-earth reading was the same, but the phase-to-neutral reading was 400 V, while the neutral was at earth potential. This was found to be due to an earth on the neutral which had caused the 5-A fuse to blow in the main switch and 400 V to exist between phase and neutral; hence the unorthodox behaviour of the lights, etc.

The supply undertaking was then informed regarding the abnormal mains voltages to earth. Very soon the mains department men were on the scene, and I was at once told that my voltmeter was not to be relied upon and was unsafe to use on the mains. After producing an ordinary moving-coil type of instrument and carefully measuring the voltage they dashed off to the nearest sub-station without further disputing the accuracy of my instrument.

Some hours after I was informed that the voltage was normal and the phenomena were due to a fault on a large installation (which they had isolated). The wiring, &c., showed a low "Megger" test to earth on two 5-A sub-circuits, but how could this be responsible for raising the neutral to 230 V and phase to 400 V above earth potential? INSIGNIFICANT.

May 9th.

A Contractor's Plea

I was particularly interested in the answer to Mr. Bland's article, "A Contractor's Plea," and I wonder if you or any of your readers can tell me what *is* the electrical law of the land as between the supply authority and the contractor?

We know, of course, that the supply authority, having to all intents and purposes a monopoly of a necessary commodity in its own district, must give a supply if the installation complies with certain regulations (such as the I.E.E.), but what is one to do when, as in Manchester, the authority refuses even to send down an inspector to test the job? I suggest that the authority is acting in restraint of trade, when, on receiving an application form signed by an unregistered contractor, it notifies the intending consumer that his contractor is unregistered and advises him to give the job to one on the registered list. What consumer, in the face of this letter and with the average consumer's dread of electricity in general, will persist in his original choice?

I am allowed to practise in Salford, Stockport, Swinton, in fact, anywhere in the neighbourhood except in Manchester, where I live, and the only reason I am given is because I am not on the National Register. I have applied for admission but was refused *pro tem.* because I have not the full five-years' qualification. One can, I suppose, appeal to the Commissioners, but this would mean establishing bad blood and would almost certainly result in my being harried by all the trivial and pettifogging rules and regulations that are usually allowed to sleep.

I have, of course, done work in Manchester, using the old dodge of a fellow-contractor's name on the forms, but this is very unsatisfactory, and I would be very much obliged to know the proper way out of what at the moment seems to me to be an impasse. RESTRAINED.

Manchester, *May 11th.*

Institution Membership

Once again reference is made in your editorial columns to the apparent lack of keenness among members of the Institution of Electrical Engineers in not seeking promotion to full membership.

Is it for lack of keenness that associate members do not seek promotion to the senior grade? In most cases I do not think it is. It seems obvious that a large proportion of the associate membership must have the necessary qualifications for promotion but do not seek it for the reason that, having attained the status of corporate membership, they do not see any advantage whatever in joining the ranks of the full members.

Most competent engineers would prefer to be judged by their ability rather than by the letters after their name; added to which, is not full membership of the I.E.E. sometimes associated, perhaps unconsciously, with advancing age, itself none too good a recommendation in these days?

There is, too, the additional subscription, which in many cases must be a very definite discouragement, since it represents an expenditure offering no apparent return. One can hardly feel that the Institution is at present in any real need of further financial support, and for those who have an extra guinea a year to spare one cannot help feeling that it would be put to much better service as an annual donation to the Benevolent Fund.

I feel sure that the great majority of associate members of the I.E.E. are not lacking in keenness and would be much more inclined to swell the ranks of full membership if any convincing reasons for, or advantages to be obtained by, taking this step could be pointed out. A.M.I.E.E.

May 11th, 1936.

High Electricity Charges

Referring to Mr. A. H. Thompson's letter on this subject in your last week's issue I would mention that the grid was not intended to be a national scheme of distribution. Its function was to attend to matters of generation and afford bulk supplies to authorised undertakers. The cost of grid supplies varies between, say, £2 17s. 6d. per kW of maximum demand to £10, according to the proximity of the grid lines to supply areas of authorised undertakers and whether selected station prices obtain, or ordinary grid tariffs, plus something for the transmission or "third schedule" charges.

It can be seen that such wide differences in costs at the source must be reflected in the trading tariffs, which no doubt accounts for the high charges which have inspired Mr. Thompson's protest. There is no doubt that uniform tariffs would greatly facilitate a more speedy and profitable development of the service, and so pave the way to cheaper prices, but until the costs attaching to bulk supplies are standardised or equated, uniform charges to consumers throughout the country are not a practical proposition.

The other aspect of this matter concerns the nature of the undertaking involved, *viz.*, whether company or municipally controlled. Hereabouts (Lancashire) there are numerous small but progressive municipal undertakings who offer domestic tariffs well below those charged by important power companies, and yet it is seriously suggested that they should be merged with the power company in the interest of the consumer. Larger areas, it is suggested, would make for economies in working and allow cheaper tariffs. The economies will have to be something very startling to make up the difference between the company and the municipal charges operating at present, and the most probable outcome of such absorptions would be to level up, rather than level down, the charges to the consumers in several areas.

For example, if Mr. Thompson was a consumer of my undertaking, cooker hire would cost him 5s. per quarter and the bill would probably show an overall unit cost (on an all-in tariff) of approximately 7/8d. It is also a doubtful point whether units at 7/8d. do not seem twice as dear to the worker in the somewhat impoverished north who earns, say, 35s. per week, as they seem to his counterpart in the more prosperous south, earning, say, 70s. per week. When viewed from that angle it almost seems that equated selling prices are required, adjusted to suit the very different requirements of the various areas.

Electricity Offices, JAMES RATCLIFFE.
Whitworth, *May 11th.*

Dictatorship

The subject of dictatorship is much to the fore at present, and, generally speaking, it is a state looked upon with displeasure. Although where dictators rule there is a tendency to overstep the mark, yet it cannot be denied they get things done.

On this ground the electricity supply industry would stand a dictatorship, as certainly its first act would be to sweep away the baker-candlestick-maker committees who try to run electricity supplies up and down the country. If the Electricity Commissioners had dictatorial power over these makeshift committees we should not read in the REVIEW under "Electricity Supply" reports such things as "No action be taken as regards the fixed charge being based on floor area rather than rateable value as suggested by the Commissioners.

May 11th. GENERATION.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electrical Dish-washing

Last week at the headquarters of the Electrical Association for Women we had an opportunity of inspecting an electrically-operated combined dish-washing machine and sink which MESSRS. H. W. RODDA & Co., 71, Lambton Road, London, S.W.20, are just marketing.

The outstanding features of the machine, which is a miniature reproduction of large models used in hotels, etc., are that the cups are held in a sideways position while being washed (thus avoiding the risk of leaving drops of dirty water inside) and that a revolving brush on a flexible shaft is provided for the cleaning of saucepans, &c.

A dish-washing machine for small families

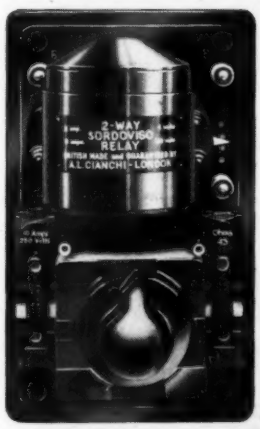
Soiled articles are placed in wire baskets, three of which are supplied with each machine, one for plates and saucers, another for jugs, cups and tumblers, and a third for silver and cutlery. These baskets are then placed one at a time in the hot, soapy water with which the machine has been filled, and the motor is switched on. The water in the machine is forced around and into the articles by the action of a revolving circulator at the bottom, the impinging water scrubbing off all loose matter. The articles in their baskets rest upon rollers and are revolved by them, enabling all parts of each article to come continually into close contact with the maximum amount of scrubbing force. After washing, the articles are rinsed as they come out by passing through a spray of fresh hot water.

Although it is intended that hot water from the domestic supply shall be used to fill the machine, the water can be heated electrically by means of a 1-kW immersion heater incorporated in the base. The papier mâche drip-board can be swivelled round over the machine for use as an ordinary sink.

To wash crockery for an average family once a day takes about five minutes, the machine using approximately ¼ kWh of electricity a week.

A Silent Staff Locating System

The numerous staff locating systems in use can be divided into two main groups, namely, those that rely on light, and those that utilise sound. The former have the merit of avoiding noise, but, since there must be a large number of fittings so that the signals can be carried to every part of the building, such installations are likely to be expensive.



The "Sordoviso" silent indicator

The "Sordoviso" silent system employs wiring as inexpensive as the sound system and consumes very little electricity (a unit capable of controlling fifty 40-W lamps works on 4 V, ¼ A). It uses the existing lighting installation of the house or institution, thus carrying the signal into every room where there are lamps. Whenever a signal is sent during the day the lights will flash, whereas at night when the lights are on they will be dimmed for a moment. In practice, it may be found necessary to use only a selected few of the lamps in each large room and corridor.

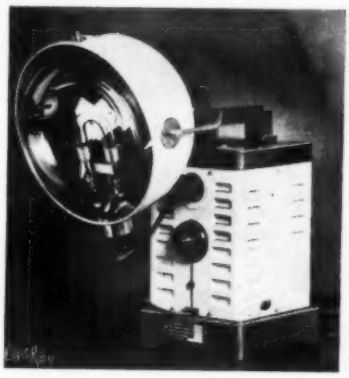
A number of different types of the apparatus have been developed. The standard and the "Major" models control respectively twenty-five and fifty 40-W lamps, working at 4 V, ¼ A. In most cases the units may be worked by means of the small current available through the existing bell system. The "Minor" and "Midget" types, controlling fifteen and five 40-W lamps, respectively, can be installed in place of the existing local switches.

All the units may be operated simultaneously from a single bell-push, or they may be divided into groups, so that the signals can be sent to one or more particular sections of the building if so desired. In this case the controlling point is furnished with a selective switch. The system operates throughout by means of small relays forming integral parts of each unit, each controlling a mercury switch.

The indicator was originally introduced by MESSRS. A. L. CIANCHI, 72, Greencroft Gardens, London, N.W.6, as an alternative to a door bell for deaf people, but its ease of application as a staff signalling arrangement led the makers to develop it further.

A Small Ultra-violet Ray Lamp

A small design of its "Alpine Sun" ultra-violet ray lamp weighing only 19 lb. has just been produced by HANOVIA, LTD., Bath Road, Cippenham, Slough, for use particularly by medical practitioners during visits to patients. Two methods of mounting permit it to be used as a mobile stand lamp or a portable hand lamp, and by means of an adjustable chromium-plated concave reflector the beam of rays can be diffused for whole-body irradiation or concentrated for local treatment.

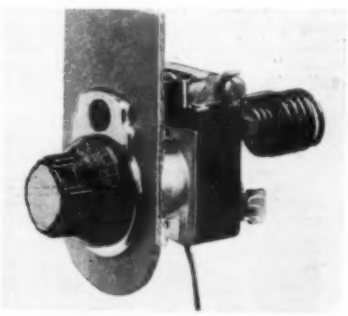


The "Junior Alpine Sun" lamp

Both a.c. and d.c. models are available and the control unit is fitted with a tapped panel enabling the lamp to be used on any voltage from 200 to 250. The actinic source is an electric-discharge tube of fused quartz, inside which a high-pressure mercury arc is generated between two solid activated electrodes.

Oven Thermostats

Oven thermostats manufactured on the hydraulic principle are a recent introduction by "DIAMOND H" SWITCHES, LTD., Gunnersbury Avenue, London, W.4. They are supplied in two types, one (as illustrated) with a pilot lamp and the other without; various modifications can be made with regard to the front knob so that it has either a Fahrenheit scale from 150 to 550 deg. or figures from 1 to 12 somewhat on the same lines as the "Regulo" knob for gas cookers. In addition, a knob of the pointer type can be supplied so that the scale itself can be on the vitreous panel of the cooker, but a small escutcheon is also provided and this has, in the case of the non-pilot light thermostat, a black inset with a white line down the centre for the correct setting of the thermostat to various temperatures. In the case of the pilot light thermostat the inset is in red and glows when the pilot lamp is alight. The lamp is illuminated while the thermostat is "on" and switches off automatically when the required temperature has been reached.



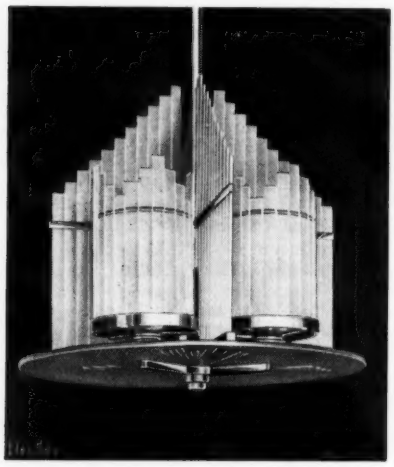
The "Diamond H" thermostat

The instrument is adaptable for easy mounting to both old and new type electric cookers, and its accuracy is of the order of ±5 to 8 deg. of the set temperature. Results depend a great deal on the exact position in which the tube is mounted inside the oven, but it is very small and compact and fits easily out of the way of utensils, cleaning cloths and other accessories. In addition, special mounting plates are supplied so that it can be easily fitted to existing cookers in service, the boring of a 2¾-in. hole in the panel being all that is necessary. The mounting plate is then clamped into position. The rated capacity of the instrument is 20 A at 250 V, a.c. only. The wound coil that is visible in the illustration is actually an external resistance which is fitted on the thermostat when incorporating the pilot lamp, and this resistance provides just sufficient voltage to light the miniature type lamp operating on 1.2 V. Only part of the capillary tube is shown, as it joins

up to a larger tube about $\frac{3}{16}$ in. in diameter which actually fits inside the oven.

"Panelstrip" Lighting Fittings

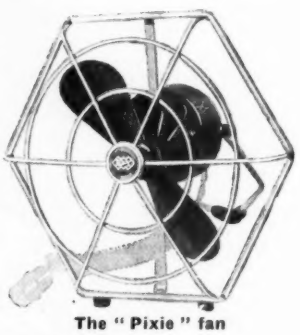
Strips of semi-opaque glass half an inch wide form the principal components of an attractive range of lighting fittings just introduced by MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2. Totally enclosed, indirect and semi-indirect models are available in a wide range of designs, and pendants and wall-brackets are supplied to match. Pastel hues of red, yellow and orange are the most favoured colours. The glass strips are cemented into chromium plated metal frameworks and are easily replaceable if broken.



A "Panelstrip" fitting

A Small Fan

The "Pixie," a low-priced, economical two-bladed fan which has lately been introduced by MESSRS. BERKELEY & YOUNG, LTD., Tyseley, Birmingham, is fitted with a 25-W induction motor and is therefore suitable for a.c. only and does not interfere with radio reception. The motor case and blades are of bakelite and there is a choice of three colours, cherry red, russet brown and jade green.

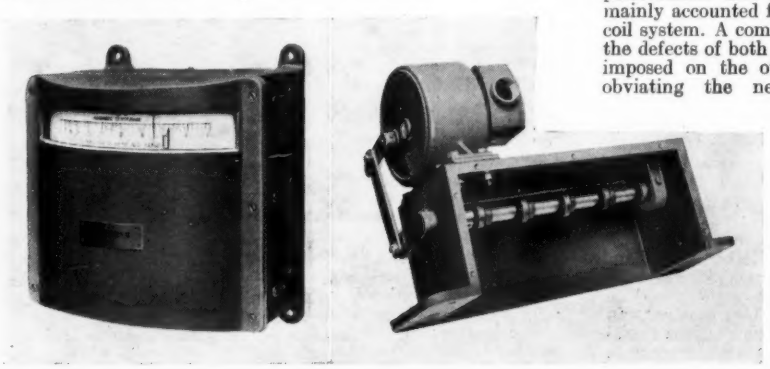


The "Pixie" fan

Spring Cleaning Electrically

We regret that in our review of vacuum cleaners last week the G.E.C. cleaner was inadvertently included in a list of cleaners relying entirely on suction, whereas it should have been linked with those using a motor-driven revolving brush and a large nozzle. We are informed by the GENERAL ELECTRIC CO., LTD., that the trade name "Magnet" is no longer used for its vacuum cleaner.

We also stated that "Generally speaking the cylindrical vacuum cleaners cost under £8, but there are a few *de-luxe* models, including the "Goblin Wizard," "Goblin Major," and "Goblin Triumph." The "Wizard" should have read "Ace" as the "Wizard" is an external bag model and was described earlier in the article.

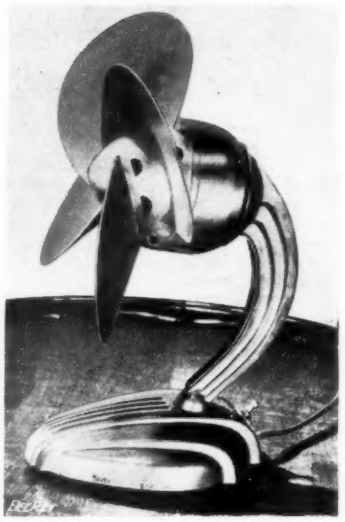


The wall-mounting Bowen pyrometer indicator, and (right) the valve-operated motor-driven camshaft

Hardening Without Decarburisation

The "Carbo-Neutral" salt bath has been developed by Messrs. SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., Great West Road, Brentford, Middlesex, for the bright hardening of high-speed steel at temperatures up to 1,350 deg. C. without decarburisation. The furnaces are special electrode salt baths provided with starting arrangements appropriate to the electrical properties of the new salt.

Demonstrations of the system are being given in conjunction with Imperial Chemical Industries, Ltd., (the manufacturers of the salt) at the furnaces exhibition held at Kelham Island, Sheffield, during the present week, as reported on page 682 of our last issue. The furnaces being shown are automatically controlled by the new Z-type temperature regulator, which is claimed to maintain a temperature of 800 deg. C. within a margin of tolerance ±5 deg. C.



A recent introduction at the Chicago Merchandise Mart was the rubber bladed fan shown in the accompanying illustration

An Aid to Hearing

Valve amplification has for some time been applied to hearing aids for the deaf, but the size of the apparatus has been a disadvantage. A new instrument has been developed by AMPLIVOX, LTD., 106, George Street, Portman Square, London, W.1, which, though it employs two stages of valve amplification, is small enough to slip into a jacket pocket, the microphone being fixed to the lapel of the coat. There is a small orifice fitting earpiece which can be clipped on to the ear. The instrument employs a 33 V dry battery and an accumulator giving 20 hr. use per charge. The frequency range is from 100 to 7,000 cycles.

The "Amplivox" instrument

Bowen Pyrometers

The pyrometers offered by the BOWEN INSTRUMENT CO., 9, Newton Road, Leeds, 7, are of the resistance, thermo-electric couple, radiation and optical types, both indicating and recording patterns being available. The maintenance of accuracy of performance and long service life of these instruments is mainly accounted for by the method of mounting the moving-coil system. A combination of suspension and pivots minimises the defects of both forms of support. Each relieves the strains imposed on the other, so affording mutual protection and obviating the need for levelling. Suspension is elastic to withstand shocks, and "zero creep" is avoided, while there is no weight on the pivots at all, their only function being to keep the moving coil concentric with the magnet poles. Thus a "chopping" pointer can be depressed every 20 sec. on to the chart for recording without imposing undue strain.

Simple deflection is employed for the "Pyroreg" automatic electrical temperature controller. The new feature of this outfit is the application of the photo-electric cell principle for interlinking the indicating pointer and the relay which actuates the controller and the furnace temperature under the influence of the pyrometer proper. When the beam of light falling on the photo cell is obstructed the cell alters the grid bias of a thermionic valve, which permits anode current to flow, so actuating the polarised switch that causes the fuel supply to be reduced. A very slight travel of the deflecting pointer is sufficient to obscure the light beam. One controller can be made to operate a number of burners by causing it to regulate a motor driving a camshaft that adjusts the several burners. These instruments cater for any temperature range and practically any heating medium, including solid fuels, in which case the controller could be arranged to move dampers or adjust the air supply.

Malayan Electrical Imports

A NUMBER of influences have been helping towards a revival in the general trade of British Malaya. The rubber and tin restriction schemes have brought about a recovery in the prices of the country's two dominant export products and have thus improved the country's capacity to import, but in the case of the tin mining concerns if increase in output had been commensurate with increase in price there would have been more orders for machinery and plant. However, as a result of the severe lesson learnt by Malaya during the slump in rubber and tin, attention has been directed to an increasing extent during the last two or three years to developing other exportable products, and considerable success has been achieved in copra and pineapples. Although the recovery of the motor-car industry in the United States and its advance in the United Kingdom have definitely strengthened the rubber market, the tin situation remains uncertain, as the increase in purchases of that metal has been largely speculative in character.

Last year the electrical trade benefited from the all-round improvement in Malayan business, as will be seen from the following figures showing the imports of the principal lines, with notes of increases or decreases compared with 1934. The United Kingdom does by far the largest part of the trade, but last year the United States made great progress in the radio business, having more than trebled the 1934 figure. (The Straits dollar=2s. 4d.).

	1935. $(000).	Inc. or dec. compared with 1934. $(000).
Automobile lamps—		
Total	11	— 2
From United Kingdom	6	+ 1
„ Japan	4	— 1
Flashlamp bulbs—		
Total	59	— 67
From United Kingdom	1	—
„ United States	17	— 12
„ British Dominions	1	—
„ Japan	20	— 13
Electric hand flashlamps—		
Total	210	— 37
From United Kingdom	1	—
„ British Dominions	127	+ 21
„ United States	41	— 3
„ Japan	14	+ 6
Other electric lamps—		
Total	254	+ 42
From United Kingdom	203	+ 64
„ Europe	21	— 9
„ Japan	29	— 12
Lighting accessories and fittings—		
Total	206	+ 82
From United Kingdom	151	+ 55
„ Japan	38	+ 20
Batteries and accumulators—		
Total	209	— 30
From United Kingdom	157	— 18
„ United States	25	— 18
Batteries for hand flashlamps—		
Total	681	+ 91
From United Kingdom	3	— 1
„ British Dominions	59	+ 8
„ United States	563	+ 94
„ Japan	6	— 5
Elecl. instruments other than telegraph or telephone—		
*Total	105	+ 50
Submarine telegraph and telephone cables—		
Total	234	†
Other telegraph and telephone wires and cables—		
Total	25	†
From United Kingdom	19	—
Other (rubber) insulated wire and cables—		
Total	462	†
From United Kingdom	416	—
„ Europe	24	—
Other (not rubber) insulated wire and cables—		
Total	199	†
From United Kingdom	194	—
„ Japan	3	—
Radio instruments and apparatus—		
Total	577	+ 310
From United Kingdom	165	+ 5
„ United States	425	+ 287
„ Japan	5	— 2
Wireless valves—		
Total	28	+ 7
From United Kingdom	9	— 4
„ United States	18	+ 11
Telegraph and telephone instruments and apparatus—		
*Total	91	+ 8
Elecl. goods and apparatus not elsewhere specified—		
Total	993	+ 255
From United Kingdom	561	+ 117
Transformers and converters—		
Total	226	+ 64
From United Kingdom	221	+ 64
Generators—		
Total	132	+ 55
From United Kingdom	117	+ 41
„ Japan	12	+ 12
Motors—		
Total	193	— 135
From United Kingdom	169	— 144
„ United States	12	+ 6
Elecl. machinery, not elsewhere specified—		
Total	320	+ 154
From United Kingdom	295	+ 170
„ Europe	17	— 5

* Mainly from United Kingdom.
† No comparable figures available for 1934.

The Argentine Electrical Market

IN the ELECTRICAL REVIEW of April 10th, Mr. H. C. Siddeley, writing on the subject of British manufacturers' prospects in the Argentine market, showed how, according to the foreign trade returns of the United Kingdom, British electrical imports into that market increased by rather more than one half between 1934 and 1935. The Argentine Government has now issued in summarised form the import and export returns for 1935.

These detail the total imports of the principal classes of electrical goods into the country, without, however, stating the countries of origin. The figures are given below, together with a note of increases or decreases (which are few) compared with the preceding year. The valuations are those fixed by the Argentine Customs Department. The rate for the paper peso is about 17 to the £.

Argentine business is in a sound condition, although the coming grain export season will be less satisfactory than last and is not expected to exercise a favourable influence on import trade. This year, however, the credit situation has been improving steadily; sums involved in bankruptcies are less than half the level of twelve months ago and money rates are easy.

	1935. Pesos.	Inc. or dec. on 1934. Pesos.
Motors and dynamos	1,792	+ 571
Electric cables	4,177	+ 105
Flex	353	+ 81
Accumulators and parts	1,294	— 3
Batteries	1,225	+ 262
Radio-telephone apparatus	819	— 574
Receiving sets	2,713	— 248
Loud speakers	308	+ 271
Radio-telephone parts	2,572	+ 851
Telephones and parts	1,117	+ 573
Circuit breakers, switches, sockets, etc.	1,158	+ 96
Insulating tape	197	— 116
Incandescent lamps	2,006	— 48
House-service meters	1,485	+ 385
Insulating tubes	954	+ 348
Elec. materials, unspecified	3,883	+ 1,028

New Books

Electrical Engineering in Radiology. By L. G. H. SARSFIELD. Pp. 284; figs. 199. London: Chapman & Hall, Ltd. Price 25s.

This is a very welcome treatise on a highly specialised subject about which far too little has been written. It will be a useful reference book for engineers engaged in X-ray work and perusal of its pages will not disappoint others anxious to obtain knowledge concerning the development and design of the X-ray machine.

Having regard to the many developments and changes of recent years, the author points out that manufacture on the lines of accepted engineering standards is now common, while the special conditions under which this type of equipment operates permit of the introduction of special standards. Much space is devoted to insulation problems, core design, arrangement of windings, dielectric stresses and general considerations of high-voltage transformer design, specimen design sheets being included. The constructional details of the various components which go to make an X-ray set are outlined, also their various characteristics, and the best operating conditions for valves are discussed. Historical surveys and results of experimental work make interesting reading, great attention being paid to mechanical rectification. The various methods of control for governing quantity and penetration of radiation and the advantages and disadvantages of the different methods of rectification, together with descriptions of the circuits used in X-ray units for various purposes, add to the completeness of the volume.

Measurement of important factors such as tube current, exciting tension, time of exposure, and comparisons between the radiation outputs of different tubes and exciting arrangements have received suitable treatment. Considerations of X-ray tubes deal with the subject more from the descriptive point of view than from the purely physical, and the author does not enter into the realm of radiography as such. The question of signals is discussed, also the importance of proper earthing, electrical safety and general protection. One chapter is devoted to descriptions of units which have been designed to meet special radiological requirements. The complete volume is well illustrated and provided with an adequate number of references.

Soviet Science. By J. G. CROWTHER. Pp. 342; plates 16. London: Kegan Paul. Price 12s. 6d.

This book presents a readable account of the scientific investigations now being carried on in Russia, where great importance is attached to fundamental research. Questions of organisation and management at the different technological institutes are given due attention, and, as might be expected, considerable space (160 pages) is devoted to physics and its associated electrical studies. Only ten pages of the sixty allocated to applied science are of direct electrical interest, and of these the description of the work at the Experimental Electro-Technical Institute of Moscow appears somewhat sketchy. However, the five-page chapter on the Electro-Physical Institute, Leningrad, compresses a good deal of information into a small space, and that on the Thermo-technical Institute, Moscow, contains useful matter of indirect electrical interest.

Parliamentary News (BY OUR SPECIAL REPORTER)

THE Brighton Corporation Bill by which power is sought to convert the tramway system in the borough to trolley-bus working and to make some extensions of the system, was considered last week by a Select Committee of the House of Lords presided over by the Marquess of Bath. Neighbouring local authorities affected by the proposed extensions and local omnibus companies oppose the Bill.

Mr. Comyns Carr, K.C., appeared for the Corporation. He said that although the tramway system was still paying its way there were signs of a falling off in receipts. For that there were two reasons; one was that although people had moved out from the centre to new housing estates the tramway system had not been extended, and the other was that people did not view tramcars with the favour that they did formerly. The Corporation was advised that both for financial reasons and for the public convenience some other form of traction must be adopted. The choice was between trolley vehicles and petrol buses. From the point of view of working expenses there was little difference, but in a hilly district like Brighton trolley vehicles would be able to maintain a faster service. They would be operated on a financial basis which would neither require any subsidy from the rates nor return any profits to the rates. The travelling public would get exactly what they paid for.

Ald. Milner Black, giving evidence in support of the Bill, said that although the tramway system only covered 9½ miles as compared with 52½ miles covered by Tillings' bus routes, tramcar passengers numbered 25 millions against 45 millions carried by the omnibuses. If the Corporation were given the powers it now sought it would be able to dispense with protective fares and he would be prepared to see the Bill amended to provide for that.

Cross-examined by Mr. F. J. Wrottesley, K.C., for the Southdown Omnibus Co., Ald. Black said that the tramways had been so profitable that they now had enough money in reserve to pay off the whole debt. Mr. Wrottesley then suggested that this was an admirable opportunity of getting rid of the tramways, in reply to which Ald. Black said that because a house was fully paid for was no reason for pulling it down.

Mr. W. T. Monckton, K.C., for the Hove and District Omnibus Co., referred to a report presented to the Corporation in which it was said that with trolley-buses the Corporation would be free from the "troublesome restrictions" of the Traffic Commissioners. Ald. Black replied that with trolley-buses the Corporation would be its own master, but with other buses it would have to obey orders.

Mr. Chas. Silvers, general manager of the Wolverhampton Corporation Transport Department, who had been called in to advise Brighton in the matter, said that after trying petrol buses on some abandoned tramway routes Wolverhampton Corporation had decided to substitute trolley vehicles. On a hilly route the average speed of a trolley vehicle and a petrol bus was about the same. The maximum speed of the petrol bus was higher but the trolley vehicle made up for that by better acceleration. A good general level of speed could be maintained by the trolley vehicle without the speed ever being excessive. That, together with quietness of running, and the absence of fumes, made the trolley vehicle more suitable in congested areas.

Continuing his evidence on Friday, Mr. Silvers dealt with the question of road maintenance. He said that when trolley vehicles were introduced in a district in which he was interested in 1923 the road was relaid. For the first five years the trolley vehicles ran on solid tyres. Nothing had been done to the road since and it was still in excellent condition. He added that he had never known the increase of receipts following the introduction of trolley vehicles to be less than 25 per cent., and in some instances it was as much as 50 per cent. In his own district it was 33 per cent.

Mr. F. J. Wrottesley, K.C., addressed the Committee on behalf of the Southdown Omnibus Co. and urged the rejection of the Bill because the trolley buses could never fit into the transport service as a whole. His clients and Tillings were willing to give the Corporation 20 per cent. of their gross earnings on the tramway routes if they were abandoned.

Emergency Telephone Calls

In the House of Commons on May 6th Mr. Keeling asked whether the Postmaster-General would state the result of his investigations of the system of emergency telephone calls.

Sir W. Womersley, Assistant Postmaster-General, said that as a result of the investigations the Postmaster-General had decided to introduce an arrangement under which, when subscribers or call office users on automatic exchanges in London and other towns wished to make an emergency call, the dialling of a special number would ensure that the exchange operator received a special signal indicating the urgency of the call. Steps were also being taken to improve the arrangements at the exchange for setting up emergency calls so as to enable the connection to be made more rapidly. This work would be completed as quickly as possible, but some few months must necessarily elapse before the requisite apparatus could be installed. There were special difficulties in the case of the smaller towns and rural areas, and the inquiries in these cases were not yet completed.

Railway Electrification

On May 6th Mr. Day asked the Minister of Transport whether he was in a position to make a statement with reference to the further electrification of main line railways and the result of the latest investigations made by the Railway Companies' Association and its conclusions.

Mr. Hore-Belisha said he was informed by the Railway Companies' Association that, apart from the schemes referred to in the Railways (Agreement) and London Passenger Transport (Agreement) Acts, 1935, the only other proposal at present definitely decided upon was the electrification of the London and North Eastern line from Newcastle to South Shields. The London, Midland and Scottish Railway Company had under examination certain additional sections of line which might be suitable for electrification, but had not yet reached any decision in the matter.

Mr. Lyons asked the Minister of Transport if he would state the number of miles of British main-line railways electrified in 1935.

Mr. Hore-Belisha said the answer was 86 route miles.

Colne Valley Electricity Bill

The Colne Valley and Northwood Electricity Bill was considered on May 7th by the Select Committee of the House of Commons on Unopposed Bills, Capt. R. C. Bourne presided. It was explained by Mr. Swallow, Parliamentary agent, that at present half a dozen local authorities held fifteen different rights of purchase over the electricity undertaking which was being operated under four separate Orders. The Bill would repeal the whole of the purchase clauses. The Bill was approved by the Committee and was advanced to the third-reading stage.

Trolley Buses in the North

The House of Commons Committee on Unopposed Bills also dealt with the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board Bill. Mr. Lees, Parliamentary agent, explained that in 1923 the Board was authorised to run omnibuses and reduce the mileage of the tramways. The latter gave a through service to Manchester and, as Manchester proposed to change over to trolley vehicles, the Board wanted to do the same in order to maintain the through service. The Nottinghamshire and Derbyshire Traction Co.'s Bill was considered at the same time. Mr. Carr, Parliamentary agent, said that the company now ran trolley vehicles over 18¼ miles of its own routes and also by arrangement ran over three miles of the Corporation system in Nottingham. It was proposed to construct a new route in order to make the services available to people in Heanor. Both Bills were approved and were ordered to be reported for third reading.

In the Courts

IN the Chancery Division on May 7th, before Mr. Justice Luxmoore, the hearing was concluded of a petition by the assignees of letters patent granted to a Mr. Davidson for "an improved apparatus for the separation and removal of dust and grit from dust laden air or from the gaseous products of combustion of furnaces" for leave to amend the specification.

The General Electric Co., Ltd., opposed the proposed amendments upon the ground that they would alter and enlarge the scope of the monopoly conferred by the patent. Other opposers of the proposed amendments were Messrs. James Howden & Co. (Land), Ltd.

At the conclusion of the arguments his Lordship made an order allowing the amendments asked for with certain modifications. The appeal from the refusal of the Comptroller of Patents to allow the amendments accordingly succeeded, and his Lordship directed that the respondents to the petition should pay one half of the petitioners' costs.

Radio Patent Action

In the Chancery Division on May 7th and following days, Mr. Justice Luxmoore heard a patent action brought by Electric & Musical Industries, Ltd., and the Boonton Research Corporation, New Jersey, U.S.A., against Lissen, Ltd., and G. Ralis (trading as Andy's Radio Supplies, Edgware Road, W.). The plaintiff brought the action for an injunction to restrain the alleged infringement of letters patent No. 376,737 granted to the Boonton Corporation on March 19th, 1930, for "Improvements in electrical wave amplifying apparatus," and which in 1934 were assigned by the Corporation to the first plaintiff.

The plaintiffs also claimed an inquiry as to damages and the reason, said Mr. Watson, why the Boonton Corporation had been joined as plaintiffs was that if the action succeeded and damages were granted they might go back prior to the date of the assignment of the patent.

The case was still proceeding as we went to press.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Works Extensions

Messrs. Santon, Ltd., are extending their works at Somerton, Newport, Mon. This represents the beginning of the first part of what will eventually be a complete new section to rehouse the overcrowded water heater and rotary switch departments, both of which have recently outgrown the present allotted space. The vacated bays will then provide accommodation for the additional room necessary for other expanding departments, and for the constant addition of presses, automatic lathes and drilling machines, spinning lathes, plating vats and the many machines necessary to make the works as nearly as possible self-contained for the complete manufacture of all Santon products. The building itself will be erected on modern lines in respect of design, construction, and natural and artificial lighting.

Registered Electrical Contractors

At the last meeting of the Executive Committee of the National Register of Electrical Installation Contractors the following applications for registration were accepted :—

Birch's, Greenheys, Manchester.
Tom Phillips, Ltd., Port Talbot.
Atozed (Kingston), Ltd., 176, Vauxhall Bridge Road, S.W.1.
McKeown & Martin, Ltd., Belfast.

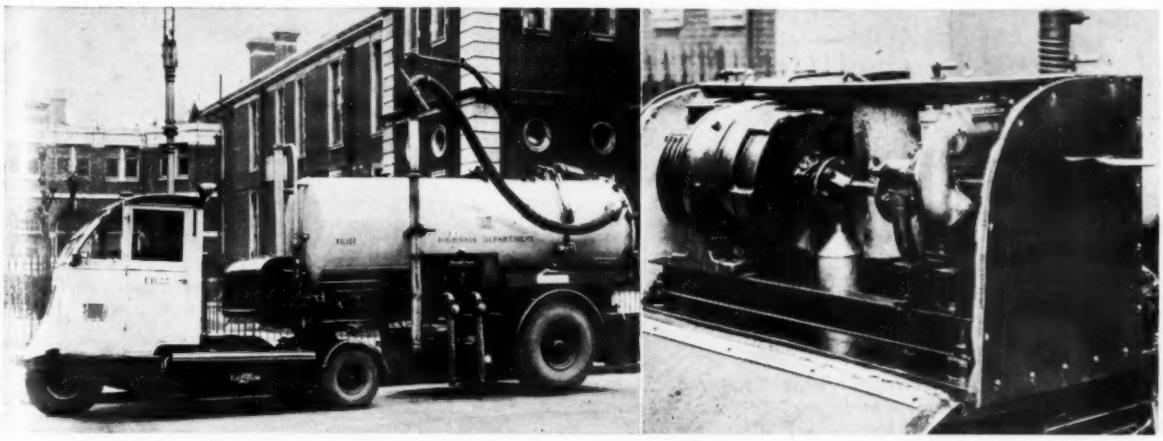
At the same meeting five applications were declined.

Gas and Electric Refrigeration in New York

Recent gas refrigeration advertisements have given the public to understand that in New York, where the gas and electricity undertakings are owned by the same company, gas refrigerators only have been chosen for sale. The E.D.A. Electric Refrigeration Committee has investigated this matter and finds that not only are electric refrigerators displayed and recommended by the company in question, but they are also being actively sold in the New York electrical undertaking area. The company, however, has arranged to leave the merchandising of electric refrigerators entirely in the hands of local electrical dealers. To see the situation in its true perspective, it should be noted that the sale of gas refrigerators in the United States last year is reported to be only five per cent. approximately of the total refrigerator sales in that country.

An Electrically Operated Gully-cleansing Machine

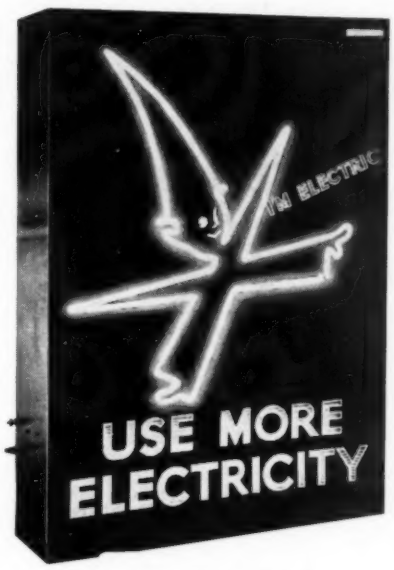
Until recently the cleansing of gullies in the City of Westminster was carried out at night time by manual labour, the use of petrol-driven gully emptiers being barred in view of the disturbance to residents. Appreciating that this was not the most hygienic method of carrying out this service, the City Council has just purchased from Electricars, Ltd., a mechanical horse drawing an articulated gully emptier, both electrically operated. The tractor unit is designed to employ standard 6-ton Scammell parts as far as possible, and the drive is transmitted to the rear axle by a propeller shaft to which an electric motor is directly coupled. The 44-cell, 364-Ah battery is carried in detachable panniers on each side. The gully emptying unit, designed by Messrs. Dennis Bros., is mounted on a trailer chassis, and has a 44-cell, 168-Ah battery mounted at the forward end. The tanks have a capacity of 800 gal. clean water and 400 gal. sludge. The vacuum pump, mounted on the near-side front end of the chassis, is directly coupled to an electric motor which cuts in automatically when the suction valve is opened. In an average day of sixteen hours the machine covers about twenty miles and cleanses sixty gullies and pits containing about five tons of sludge. The capacity of the batteries, which were supplied by the D.P. Battery Co., Ltd., and the Chloride Electrical Storage Co., Ltd., is sufficient to operate the machine for sixteen hours.



An electrically operated gully-cleansing machine just put into service at Westminster. Right: The vacuum pump direct-coupled to an electric motor

Neon Box Signs

The accompanying illustration shows a neon box sign designed by E.D.A., attention to which is drawn in the Association's sales and publicity programme for June. The size is approximately 36 in. by 24 in., and the outline figure is illuminated in blue neon, while the eye winks and the slogan flashes at frequent intervals. The E.D.A. processional car this year makes a feature of the figure. The hire charge, including the services of the driver is £10 per day. Particulars are also given in the programme of stereoscopic signs and a neon sign for exterior display of the "I'm Electric" figure.



An E.D.A. neon box sign

New Electricity Offices for Wimbledon

To provide much-needed accommodation for the growing staff of the Wimbledon Corporation Electricity Department, new offices costing £9,000 were officially opened on May 6th at Electricity House, Durnsford Road. Alderman A. W. Hickmott, chairman of the Electricity Committee, performed the ceremony, and after briefly describing the purposes of the building he paid a tribute to the borough electrical engineer (Mr. A. E. McKenzie) and his staff for their work in connection with the recent expansion of the undertaking. As an indication of the extent of developments in the domestic field Mr. McKenzie gave the following figures for apparatus connected :—

	1934	1935	1936 (up to May 6th.)
Electric cookers	1,213	1,667	616
Electric cookers replacing gas cookers ...	—	847	310
Thermostatically controlled water heaters	1,298	2,482	795
Immersion heaters	761	945	260
Wash-boilers	440	590	200

It is estimated that two thousand cookers will be installed this year, and at March 31st last the totals for the various appliances in service were :—Cookers, 7,500; water heaters, 9,308; washers, 2,315; irons, over 7,000; kettles, 6,271; and

radiators, 8,500. Wimbledon is also showing itself very "refrigerator-minded," and since the half-a-crown a week hire-purchase scheme was initiated in February no fewer than 79 of them have been installed. Of the 59½ million kWh of electricity sold last year about 60 per cent. was for domestic purposes.

As a souvenir of the opening ceremony the mayor, Ald. J. S. Holland Abbott, presented Ald. Hickmott with an electric kettle. Following a vote of thanks to the mayor proposed by Coun. F. V. Hilton, vice-chairman of the Electricity Committee, the visitors inspected the new building. The ground floor, in addition to housing a 5,000-gal. boiler fitted with four 40-kW Heatrae immersion heaters for warming the building

A display at "Revo" electric cookers arranged by the Preston Corporation Electricity Department

and also a 60-gal. Hotpoint cylinder for domestic hot water, is used as an overflow for the adjoining repair department where in the last five years 12,580 repairs have been carried out. An indication of the efficiency of this department is the fact that a kettle can be completely reconditioned for less than half-a-crown. The remaining two floors are occupied by general offices, mains and domestic hire departments, drawing offices, rest rooms, &c. G.E.C., Harcourt and Benjamin fittings have been used to light the building, which has been equipped with Siemens intercommunication telephones, an electric fire-alarm system (Associated Fire Alarms, Ltd.), and electric clocks of various makes.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, May 13th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £17 5s., 15s. dec. Spelter, £14 12s. 6d., 5s. dec. English block tin, £204 5s., £1 5s. dec.

Messrs. Edward Till & Co. report, May 13th: No change in the price of India rubber, Para fine.

The "Queen Mary"

After our article on the "Queen Mary" (page 692) had gone to press we received further information regarding the work carried out by Messrs. Falk, Stadelmann & Co., Ltd., who designed lighting fittings as an integral part of the furnishing schemes. One instance is provided by the deck indicator signs (illuminated from below) for the fore and aft stairs and another by the novel desk lighting arrangements. The ceiling and soffit fittings supplied by this company range in size from 1 ft. 6 in. to upwards of 4 ft. in the principal state-rooms and Turkish baths, each made for its particular position. All metal-work is in silver bronze with glassware of various types and colours to suit the surroundings.

An Electrical Exhibition at Corby

An electrical cooking week and exhibition was held recently at Corby, Northamptonshire, by the Kettering U.D.C. Electricity Department. The exhibition consisted of display stands of electrical apparatus, coupled with cooking demonstrations twice daily. An average attendance of over fifty was recorded at the demonstrations. Children's essay-writing competitions and cake-baking competitions proved popular. The children's essays were entitled "How Electricity Helps in the Home" and were divided into classes, according to age, the winner of each class receiving a prize. In the cake-baking competition the only stipulation laid down was that the cakes must have been baked in an electric oven. The prizes consisted of electric fires, irons, toasters, &c. The total of electrical apparatus already on hire in Corby consists of over 2,000 items. The engineer and manager of the Kettering electricity undertaking is Mr. W. A. Walker, A.M.I.E.E.

The Electricity Supply Rifle League

As a result of the matches shot during April, the leaders of the various divisions of the Electricity Supply Rifle League are as follows:—First division, City A"; second division, City "C"; third division, Clesco, S.E.; fourth division, Barking "B."

The Forty-hour Week at Manchester

How the introduction of the forty-hour week would affect the Manchester Corporation Electricity Department is dealt with in a report which has been presented to the City Council. The adoption of the shorter week would entail 463 additional employés in the Electricity Department alone and would incur a total annual additional expenditure of £90,900. The Establishment Committee states that it would be difficult to pass on to consumers the consequential increased charges unless a forty-hour week were general. No attempt had been made to estimate the annual cost of tools, depôt facilities, &c., which would be required for the larger staff.

A Cooker Display at Preston

The accompanying illustration shows an effective window display of "Revo" electric cookers recently arranged by the Preston Corporation Electricity Department. The Corporation hires out "Revo" electric cookers fitted with "Superspeed" boiling plates exclusively.

Inadequate Wiring of Houses

Speaking on "Domestic Electrification" at a luncheon of the Birmingham Circle of the British Electrical Development Association at the Midland Hotel on May 5th, Mr. R. H. Rawll, sales and development engineer of the Birmingham Electric Supply Department, said that he thought the reason why many houses to-day had inadequate or unsafe wiring or no wiring at all for power was the lack of co-operation and knowledge among the various bodies concerned. There was a definite demand by the public for a different method of providing electrical facilities. He considered that the proposals of the Electrical Association for Women might be discussed with advantage and that electrical contractors could render valuable assistance to architects and builders. Complaints were made by Mr. Peter King that architects received bad instructions from clients and that there did not appear to be any uniform standard of specification. The aims of E.D.A. were outlined by Sir Percival Bower, chairman of the Electric Supply Committee. Mr. S. N. Watkins presided.

Up-to-date Shop Lighting Methods

The Synchronome Co., Ltd., informs us that its standard "Synchronome" electrical impulse clock system (not "Synchromains" clocks) is installed in the new Piccadilly premises of Messrs. Simpson, described in our last week's issue.

An Industrial Lighting Installation

An example of how the modern trend in industrial lighting is affecting the woodworking and furniture trade is to be seen at the Willesden works of Vi-Spring Products, Ltd. At an early stage in the design of these new works arrangements were made for a modern scheme of high intensity lighting, and in the accompanying illustration we show the first floor assembly

The works of Vi-Spring Products, Ltd., Willesden, lighted by means of Holophane industrial reflectors

benches lighted by Holophane intensive type industrial reflectors with 200-W lamps. On the ground floor Holophane reflectors with 300-W lamps have been installed. The electrical contractors who carried out the installation were Messrs. G. W. Franklin & Sons.

Municipal Trading at Luton

The Luton Town Council at its meeting on May 5th received a deputation of local electrical traders with reference to the use of the new electricity showrooms. Members of the deputation intimated that they did not object to sales or hire-purchase arrangements, but they contended that municipal trading in principle was wrong, and that unless there were very exceptional circumstances, sales should not take place. If the object was to increase the consumption of electricity, that could well be achieved by using the showroom as a showroom only and leaving sales to be made by the local contractors. The particular unfairness to retail tradesmen was that for some thirty years local electrical contractors had invested

capital in businesses that had had the direct result of increasing the business of the electricity undertaking. They had also put capital into showrooms in the main thoroughfares of the town, and now they were to be subjected to the direct competition of the Council. The Mayor explained that under Standing Orders the matter could not be discussed further for six months.

Membership of the E.C.A.

At a recent meeting of the Council of the Electrical Contractors' Association the question of the eligibility of electricity supply authorities and manufacturers for membership of the Association was discussed. As regards the former it was decided to await further information. So far as manufacturers were concerned it was resolved that firms employing electrical labour for the purpose of carrying out work similar to that performed by electrical contractors were eligible for membership of the National Federated Electrical Association (the allied body dealing with labour and wages question). With regard to membership of the E.C.A. and the National Electrical Contractors' Trading Association, Ltd., in the event of applications being received from manufacturers each case should be considered on its merits.

Catalogues Wanted

Messrs. Walkers' Electrical Service, 2, Marine Gardens, Margate, ask for catalogues of shop-window reflectors from manufacturers and importers.

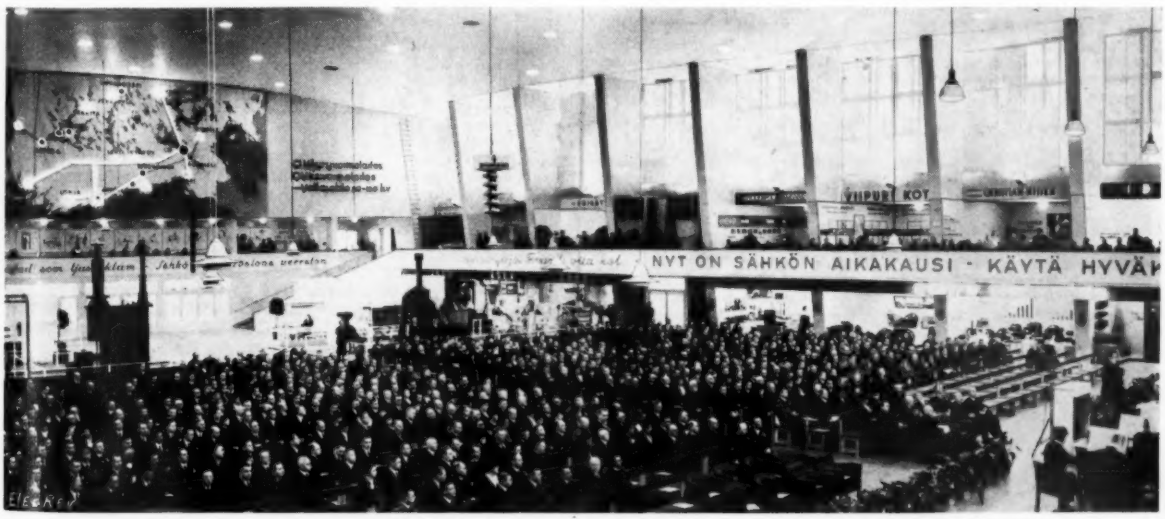
Social Events

The annual one-day conference and golf match between the Council of E.L.M.A. and the E.C.A. of Scotland was held at Gleneagles Hotel, Perthshire, on Wednesday, April 29th. This was the seventh occasion on which such a gathering had been held, and, as usual, it was favoured with ideal weather and the large company which came from the South thoroughly enjoyed the gathering on the Perthshire hills. The golf match was made up of teams of twelve-a-side. Singles were played in the forenoon and four-ball foursomes in the evening. In the afternoon the business conference was held, at which trading relations and many matters of mutual interest to both sides of the conference were discussed and mainly adjusted to the satisfaction of both parties. The result of the match, singles and foursomes, was on this occasion a win for E.L.M.A., so the cup returned south, after being held for two consecutive years by the Scottish Contractors.

The annual sports and gala of the General Electric Co., Ltd., will be held on June 27th at the company's London sports ground, Preston Road, Wembley.

A Finnish Electrical Week

In connection with the recent electrical week held in Finland, a large exhibition was held in Helsinki (Helsingfors), and in the accompanying illustration we show an interior view of the Masshallen during the inaugural ceremony. The audience included many leading Finnish electrical engineers. Various slogans decorated the walls and the balcony, one example being "Cook with Finland's White Coal."



The scene at the inaugural ceremony of the electrical exhibition at Helsingfors, held in connection with the recent Finnish Electrical Week.

Trade Announcements

The Kandem Electrical, Ltd., has removed to 769, Fulham Road, S.W.6.

Owing to continued expansion, Messrs. Gittings & Hills, Ltd., have acquired a factory adjoining their present works, Nechells, Birmingham, and new buildings are in course of erection for housing cellulose and synthetic enamel production.

Mr. F. V. Wythes, formerly general manager of the Siluminite Insulator Co., Ltd., announces that he has sold his patents and processes to Interohm Electrical Insulators, Ltd., 31/32, Grosvenor Place, London, S.W.1, of which he is the general manager. The latter company specialises in all kinds of electrical insulating materials.

For Sale

The Ayrshire Electricity Board has for disposal boilers, turbo-alternators, pipework, &c.

East Grinstead U.D.C. invites offers for the purchase of two 60-kW generating sets, one 120-kW and one 160-kW dynamos.

Coventry Electricity Department has for disposal turbo-alternators and water tube boilers.

Essex County Council has electrical generating plant for sale.

(See our classified advertisements.)

Orders Recently Booked

Amalgamated Anthracite Collieries, Ltd., has placed an order with Simon-Carves, Ltd., of Cheadle Heath, Stockport, for a new boiler plant which is to be installed at its No. 3 Great Mountain Colliery, near Swansea. The contract includes two Simon-Carves multiple drum-type water tube boilers with patent water wall combustion chambers and water cooled suspension arches. Each boiler will have a maximum evaporative capacity of 36,000 lb. of water per hr., and will be equipped with a chain grate stoker, economiser, forced and induced draught fans. Simon-Carves are also to supply the coal handling plant, feed pumps, boiler house building and chimney, and all auxiliaries. The boilers are designed to burn anthracite duff which will contain a large proportion of aspirated dust obtained from the colliery screening plant.

International Combustion, Ltd., has received an order from Caldwells Paper Mills for reconditioning an existing boiler. At the present time this boiler is fired by Underfeed "A" stokers which will be taken out and replaced by an "L" stoker 15 ft. wide and 15 ft. long. The contract also covers the installation of a Lopulco finned tube front wall complete with headers, connecting pipes and ash hopper. Orders have been received for stokers for Table Bay power station, Capetown and Thames Board Mills, Ltd. The stokers for Capetown comprise two twin "L" stokers, each being 30 ft. wide by 18 ft. long, giving a grate area of 540 sq. ft. The Thames Board Mills order is for two "L" stokers each 14 ft. wide by 16 ft. long, giving a grate area of 224 sq. ft. This contract also includes the supply of furnace arches and secondary air equipment. Two coal-handling orders have been received recently, one from the Larne Electricity Works, Northern Ireland, for a complete coal handling plant comprising elevator and drag link conveyor for handling fifteen tons of coal per hour, with elevated storage bunkers, chutes and gates. The second order covers special chain and bucket elevator with jigging feeder for the Fife Coal Co., Ltd.'s central power station, Kelty. This elevator will be a duplicate of the existing one and is designed to deal with sixty tons of coal per hour. An order from the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., is for a No. 1 size Beaumont drag scraper, together with a belt feeder, the capacity of which will be forty tons per hour.

Quarry Blasting in Yorkshire

Henley cables were used on April 3rd to carry the current for a blasting operation at the Horton Quarry of the Settle Limes, Yorkshire, when 42,000 tons of limestone was mined from the quarry face 132 ft. high. The survey of the cliff face and the excavation of the tunnels to accommodate the explosives (3¼ tons of black powder) were started in January this year. The tunnel was excavated at the foot of the quarry-face 37 ft. into the limestone, with a 27 ft. cross-tunnel, making the shape of a "T," at each end of which the explosives

were placed in cavities. The firing was by 72 ft. of Cordean fuse, the impulse to which was transmitted by 500 yd. of 3/.029 class VW Henley cable. The shot was fired by Mrs. Cooper, wife of Mr. Leonard Cooper, a director of Settle Limes, in the presence of the directors of Settle Limes, and many quarrying experts and geologists. It was considered to be a complete success. Settle Limes own four

The Horton Quarry of the Settle Limes, Yorkshire, showing the results of a large blasting operation

limestone and two granite quarries. One quarry has already been electrified and is taking a supply from the Settle and District Electricity Co., Ltd., while proposals for the electrification of a second are under consideration.

Tables of Electricity Undertakings

We have received from Messrs. Benn Bros., Ltd., a copy of "The Electrician Annual Tables of Electricity Undertakings" for 1936 (10s. net, postage 9d.). This is the forty-ninth edition, and its 242 pages of useful data concerning hundreds of undertakings compare strikingly with the small format and scanty information contained in the earliest issues nearly half a century ago when, as the Editor observes, the phrase "all-electric" seemed Utopian.

New Catalogues and Lists

Renold and Coventry Chain Co., Ltd., Renold Works, Didsbury, Manchester.—A description of the company's chain drive applications.

T. Bolton & Sons, Ltd., P.O. Box No. 3, Widnes, Lancs.—An illustrated booklet (Pp. 32) dealing with phosphor bronze and bound by a p.b. spiral.

G. Bray & Co., Ltd.—A folder dealing with "Scallak" anti-scale immersion heating units for thermal storage water heaters.

H. Breakell & Co., Dewhurst Street, Blackburn.—A blotter illustrating a modern electric lift installation.

A. J. Coleman & Co., 37/44, The Arcade, Northampton.—An 84-page catalogue of electrical fittings and accessories.

Heyes & Co., Ltd., Wigan.—Details of "Wigan" flameproof fittings and accessories.

L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, London, W.C.2.—A catalogue of "Crompton" fans.

International Combustion, Ltd., Aldwych House, London, W.C.2.—Full details, with drawings, of the "Rovac" rotary vacuum filter for separating liquids and solids from different types of slurries.

Normand Electrical Co., Ltd., 3, North Side, Clapham Common, London, S.W.4.—A booklet explaining the method of construction used in the "Maxflux" stator.

Drayton Regulator & Instrument Co., Ltd., West Drayton.—A copy of the "Drayton-Armstrong" steam trap book containing a handbook section, catalogue section and service section. Also a catalogue of circular chart type recorders for temperature, pressure and liquid levels.

Hopkinsons, Ltd., Huddersfield.—A folder describing safety valve silencers.

Mica Manufacturing Co., Ltd., Volta Works, Bromley.—Leaflets on the new non-tracking "Micaloid" moulding.

Bankruptcy Proceedings

J. Newton, lately carrying on business as "The Gateshead Electrical and Radio Service," 23, Whitehall Road, Gateshead.—The public examination herein was held on May 1st at the Court House, 56, Westgate Road, Newcastle-upon-Tyne. It was reported that the gross liabilities were £2,135, of which £1,474 was expected to rank for dividend, and there was a deficiency of £1,440. Debtor said he commenced business in 1932 with a capital of £1,346, and in order to increase his turnover he sold wireless sets on hire-purchase terms. Between 1933 and 1936 he sold about 250 sets in this way. He attributed his failure to ill-health, depreciation in the value of sets taken back owing to customers defaulting and bad debts. The examination was adjourned.

L. Hardaker, 32, Broadgate Walk, Horsforth, Leeds, lately carrying on business at 293, Low Lane, Horsforth, Leeds, radio and electrical engineer.—The public examination herein was held at the County Court House, Albion Place, Leeds, on May 5th. It was stated that there was a deficiency of £75. The examination was adjourned for formal closing.

D. F. B. Bate and **G. S. C. Bate** (Bate Bros.), radio engineers, lately trading at 165, Oxford Road, 192, Colne Road and 33, Manchester Road, Burnley.—Trustee, Mr. H. S. Haworth, 7, Lord Street West, Blackburn, Official Receiver, released April 30th.

P. T. King, electrical engineer, 8, Buxton Road, and 20, Gordon Street, Luton.—Receiving order made May 4th on debtor's own petition. First meeting May 15th at 11, George Street West, Luton. Public examination May 26th at the Court House, Luton.

J. E. Donley (J.E.D. Installations), electrical contractor, 67, Stracey Road, Forest Gate, E.—Receiving order made April 30th on debtor's own petition. Public examination June 17th at Bankruptcy Buildings, Carey Street, W.C.

D. A. Bolton, electrical contractor, Palace Chambers, Bridge Street, Westminster, S.W.—Last day for receiving proofs for dividend May 20th. Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, W.C., Senior Official Receiver.

G. F. Kennedy (Kennedy & Co.), electrical engineer, Market Square, Shepton Mallet.—Last day for receiving proofs for dividend May 20th. Trustees, Mr. H. Wheeler, 26, Baldwin Street, Bristol, Official Receiver.

J. Cooper (J. Cooper & Son), electrical engineer, 30, Warner Street, Haslingden.—First and final dividend of 2s. 5½d. in the £, payable May 20th at the Official Receiver's office, Byrom Street, Manchester.

H. Rollaston, electrical contractor, 61, Stafford Street, Derby.—Public examination May 19th at 20, St. Peter's Churchyard, Derby.

J. W. P. Swale, radio and electrical engineer and dealer, 59, Wakefield Road, Moldgreen, Huddersfield.—Public examination June 10th at the County Court, Huddersfield.

J. A. Cane, T. P. Cane and **D. R. Cane** (Cane Bros.), consulting and electrical engineers, Sturry, Kent.—Application for discharge to be heard on June 9th at the Guildhall, Canterbury.

C. I. Hughes, electrical dealer, County Road, Ormskirk.—Receiving order made May 6th on a creditor's petition.

Company Liquidations

Bonnella Brothers, Ltd.—Winding up voluntarily. Liquidator, Mr. B. de V. Hardcastle, Coventry House, South Place, E.C.2. The registration of a new company, Bonnella Bros. (1936), Ltd., is reported on page 727.

A. E. Rising, Ltd.—Winding up voluntarily. Liquidator, Mr. C. Hayter, 3A, Friern Watch Parade, North Finchley, N.12. Particulars of claims to the liquidator by June 30th.

Electric Cushions, Ltd.—Winding up voluntarily. Liquidator, Mr. G. H. Warmington, 73, Basinghall Street, E.C. Particulars of claims to the liquidator by June 19th.

John Short, Ltd.—Meeting June 15th at 7, Queen Street, Norwich, to receive an account of the winding-up by the liquidator, Mr. H. P. Gowan.

Meeting of Creditors

Electrical Equipment & Carbon Co., Ltd.—A meeting of creditors is to be held on May 18th at the Holborn Restaurant, High Holborn, London, W.C.1, to consider whether a liquidator shall be nominated for the purpose of winding up the affairs of the company and distributing the assets and whether a committee of inspection shall be appointed.

Dissolutions of Partnership

Hutchison & Handley, electrical engineers and contractors, 16, Drummond Avenue, and 42, Weymouth Road, Blackpool.—Messrs. D. C. Hutchison and P. G. Handley have dissolved partnership.

Bannermore & Co., mechanical and electrical engineers, 6, Nelson Street, Bristol.—Messrs. V. Banner and A. M. O'Ferrall have dissolved partnership. Mr. O'Ferrall will carry on the business.

The Contractors' Conference

AS we mention in a leaderette this week, the Electrical Contractors' Association is to hold its annual conference as usual this year instead of the "skeleton" meeting in London which the Council had provisionally decided upon. The conference is to take place at Folkestone from July 8th to 10th.

A provisional programme which we have received from Mr. L. C. Penwill, the director and secretary, indicates that the function will be on similar lines to those followed at previous conferences. Folkestone is an excellent choice, and its proximity to London should ensure an attendance at least as good as those experienced in previous years.

The following are the details of the programme as at present arranged:—

Wednesday, July 8th.

10.30 a.m. Meeting of the Council of the three Associations (E.C.A., N.E.C.T.A., Ltd., and N.F.E.A.).

2 to 10 p.m. Arrival of delegates at the conference and registration at the Metropole Hotel

9 p.m. Reception by the President. Cards, dancing and light refreshments at the Metropole Hotel.

Thursday, July 9th.

10.30 a.m. Civic welcome by the Mayor of Folkestone at the Leas Cliff Hall, and reply by the President. Presidential address by Mr. A. G. Bruty, M.I.E.E.

2.30 p.m. Conference reassembles at the Leas Cliff Hall.

8.30 p.m. Ball and supper at Leas Cliff Hall at the invitation of the Mayor.

Friday, July 10th.

10 a.m. Annual general meeting of the E.C.A. and Allied Associations at the Leas Cliff Hall. Time will be provided for a general discussion on all matters of Association interest.

12 noon. Votes of thanks. Installation of new president. Short address by new president.

2.30 p.m. Garden party (details to be announced later).

8.30 p.m. Smoking concert and dancing at the Metropole Hotel.

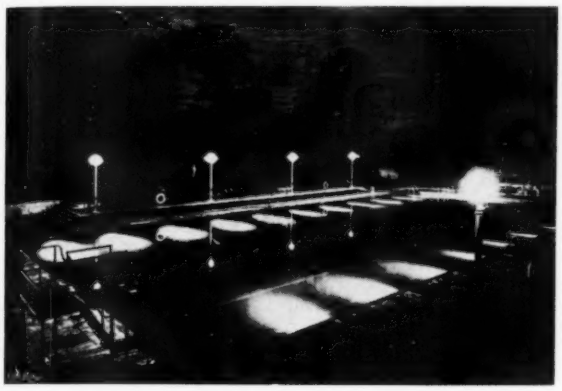
Electricity Supply

Lighting, Domestic, Power

Belgian Congo.—INCREASED OUTPUT.—As a result of new arrangements for the supply of power to the Société Union Minière du Haut Katanga and the Société Générale Africaine de l'Electricité the output from the hydro-electric station of the Société Générale de Forces Motrices Hydro-Electriques du Katanga amounted last year to 153 million kWh as compared with only 89,350,000 kWh in 1934. The height over the dam has recently been raised with the result that the capacity of the water storage reservoir has been doubled.

Burnley.—ELECTRICAL DEVELOPMENT.—Schemes of electrical development estimated to cost £10,852 have been approved by the Town Council.

China.—OVERHEAD DISTRIBUTION.—It is reported from Shanghai that a scheme for the establishment of a network of transmission lines capable of supplying power to villages along the Shanghai-Nanking and Shanghai-Hangchow Railways is being developed. British, German and Czecho-Slovakian firms are reported to be supplying equipment for the extensions.



The Trentham Park swimming pool illuminated by G.E.C. underwater floodlight projectors and pylons flanking the sides

Dewsbury.—INQUIRY.—A Ministry of Transport inquiry was held on April 28th by Col. F. Gordon Tucker into an application by the Yorkshire Electric Power Co., for permission to run overhead lines over land at Chickenley owned by the Stephenson Trust, in order to give an additional point of supply to the Dewsbury Corporation for part of the Chickenley and Chickenley Heath areas. The owners of the land suggested an alternative route, which was impracticable because of the high voltage and the regulations regarding clearance of buildings. The objection was on the ground that the land in question was required for building purposes, but it was contended that there was no prospect of building operations for a considerable period.

Chichester.—SUPPLY TO BOSHAM.—The existing supply to Bosham is to be supplemented at an estimated cost of £2,500.

Congleton.—A GAS CHAIRMAN'S PROTEST.—At a recent meeting of the Town Council Ald. F. Jackson, chairman of the Gas Committee, moved the reference back of a recommendation of the Electricity Committee "that the electrical engineer be authorised to obtain and erect a lamp standard . . . . and illuminate the same by electricity," observing that the whole matter was out of order as the Gas Committee had always been responsible for street lighting. However, the Council approved the recommendation by eleven votes to eight.

Dundee.—GENERATOR FOR WATERWORKS.—A 15 h.p. turbo-generator, costing £600, is to be installed at the Lintrathen waterworks by the Water Committee.

East Wilts.—RURAL SUPPLIES.—Representations from the parish councils of Collingbourne Kingston and Collingbourne Ducis have been made to the Ministry of Transport with regard to a supply of electricity by the Wessex Electricity Co. The company states that a canvass of villages in East Wilts met with disappointing results, as the maximum revenue likely to be secured in the third year from the commencement of a supply would be £470, or 12 per cent. of the estimated capital expenditure of £3,869. It might, however, carry out the extension on obtaining guarantees of 15 per cent.

France.—HIGH-VOLTAGE TRANSMISSION LINES.—The Société Lorraine-Champagne has been authorised to proceed with the erection of a 150-kV transmission line between Revigny and Rheims, a distance of about 56 miles, and one at the same voltage between Ormes and Damery (12½ miles).

Gainsborough.—REVISED CHARGES.—For the fifth year in succession Mr. H. Breckell, the electrical engineer and manager, has announced reductions in the electricity charges. The changes are as follows (old rate in brackets): First 7 (9) kWh per quarter per 100 W 6d. per kWh in the summer and first 15 (18) kWh in the winter, and 1½d. thereafter. Two-part tariff: Running charge for between 40 and 80 kWh per quarter reduced from ¾d. to ½d. per kWh.

Germany.—INCREASED OUTPUT IN BERLIN.—A report just to hand shows that the output of the various power stations of the Berliner Kraft und Licht Gesellschaft (Bewag) amounted during the past year to 1,484 million kWh, as compared with 1,347 million kWh in 1934, and that the number of consumers increased during the same twelve months from 1,176,273 to 1,230,050.

Glasgow.—PINKSTON POWER STATION EXTENSION.—Application is to be made by the Transport Committee for authority to install another turbo-alternator at Pinkston at a cost of £100,000. The extension is necessitated by the electrification of the subway.

Hampshire.—OVERHEAD LINE INQUIRIES.—Mr. T. J. D. Atkinson held a Ministry of Health inquiry last week into the application of the Mid-Southern Utility Co., Ltd., for consent to place overhead lines in Tower Hill, Southwood Road, Southwood Lane, and Iveley Road, and also at Cove. For the company it was stated that the proposed line would be a continuation of lines already existing, which were erected as a result of a previous inquiry. The Farnborough Council objected chiefly on the grounds of amenity. There was a similar application in respect of the Crookham ward of Fleet. It transpired that the Hampshire County Council did not oppose, and the main objections of the Urban District Council were that overhead lines were dangerous in a residential neighbourhood. On behalf of the company it was stated that the intended supply could not be given unless overhead lines were used, owing to the cost.

Harrow.—REFRIGERATOR HIRE-PURCHASE SCHEME.—The Harrow Electric Light & Power Co., Ltd., has begun a campaign for popularising electric refrigerators, and is offering 3-cu. ft. models on hire-purchase terms of 2s. 6d. per week.

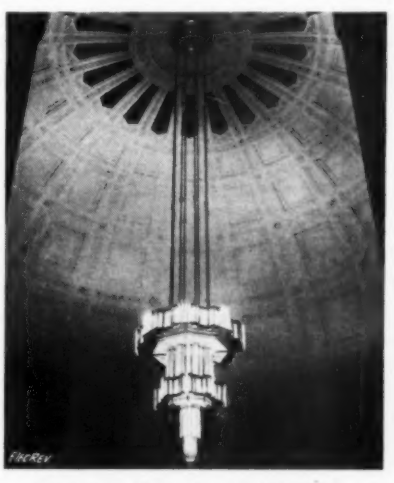
Hastings.—NEW EQUIPMENT.—The Electricity Committee has approved a scheme for e.h.v. mains extensions and plant costing £10,020. Surplus revenue is to be utilised for the purchase of cookers and heaters (£6,000) and meters (£7,000).

Huddersfield.—LOANS.—The Town Council has applied for loans of £4,000 for mains, and £2,000 for sub-station equipment.

Hull.—NEW EQUIPMENT.—The purchase of the following has been authorised by the Electricity Committee. On-load tap changing equipment, (£588); circuit-breaker tanks and arcing contacts for type 2A1 circuit-breakers, (£1,746); a 750 kVA transformer (6,600/11,000 V) with automatic on-load tap changing equipment (£780); six feeders, (£1,528); six transformer panels (£1,351), and three l.v. switchboards (£900). Sanction has also been obtained to a loan of £54,990 for mains.

Irish Free State.—DUBLIN.—The report of the Waterworks Committee regarding the proposed joint hydro-electric and waterworks scheme at Poulaphouca, Co. Dublin, has been adopted by the Corporation. Mr. Kelly, moving the adoption of the report, said that the Corporation, under the terms of the agreement, would pay £129,000 to the Electricity Supply Board. The manager and the engineer informed the Corporation that this sum would save it the expense of introducing a special Bill to provide a water supply of its own and that it would escape the necessity of constructing a dam and other costs in connection with compensation, &c. Mr. J. J. Byrne said that the Corporation was giving away the water rights of the city to the E.S.B. for all time, and, in addition, was contributing £129,000.

Leeds.—UNIVERSITY LIBRARY LIGHTING.—The new library building for the University of Leeds, known as the "Brotherton Library," is equipped throughout with special lighting fittings made and supplied by Messrs. Troughton & Young, Ltd., to the designs of the architects, Messrs. Lanchester & Lodge, and under the supervision of the consulting engineer, Mr. J. A. McLay. There are 115 of these fittings. The main one (illus.) is that in the dome of the central hall of the building, suspended on eight steel tubes 37½ ft. long. Its total weight is about 2½ tons and its loading about 17,000 W, including eight 500-W projectors on the internal framework for floodlighting



The main fitting in the University Library Building, Leeds

the interior of the dome. In the "ambulatory" of the central hall there are twenty fittings similar to, but smaller than, the central one, each loaded at 440 W. The switching is controlled from two points at the main entrance to the central hall. There is a large 700-W suspension fitting at the rear of the main building in the room for the "Brotherton Collection," with subsidiary box fittings mounted directly on the ceilings in some cases and, in others, arranged to cloak the openings for the inlet and extraction ducts of the ventilating system.

ELECTRICAL EQUIPMENT AT A HOSPITAL.—Tenders are being invited by the Leeds Electricity Committee for the reconstruction of the lighting system and the installation of sterilisation plant at St. James Hospital.

London.—CAMBERWELL LIGHTING.—A further stage in the proposal to convert the whole of the street lighting of Camberwell from gas to electricity was reached when the Borough Council's application for sanction to a loan of £36,417 came before the London County Council last Tuesday. The L.C.C. Finance Committee, recommending that permission for the loan should be given, noted that the technical details of the scheme were sound, being in accordance with up-to-date practice and the recommendations contained in the Interim Report of the Departmental Committee on Street Lighting. The Borough Council proposed to enter into a contract for the installation of the necessary equipment and for a supply of electricity, together with the maintenance of the system, for fifteen years. At the end of that period, during which the Borough Council would pay £23,550 annually, the equipment would become its property. The cost of the installation (£36,417) was included in these payments.

A fine example of screen lighting at the Malvern College Chapel. The effect is obtained by a special combination of architectural and floodlighting units installed by Messrs. Abell & Smith's Electrical Co., Ltd., Worcester

SCHOOL SUPPLIES.—The L.C.C. Education Committee is to install electric lighting and power at Addison Gardens school, Hammersmith; Clyde Street school, Deptford; Sunnyhill Road school, Streatham; and Thomas Street school, Limehouse.

SOUTHWARK.—Lighting in the East Street market is to be improved at a cost of £517.

ST. PANCRAS.—At a recent meeting of the Electricity Committee the electrical engineer reported that for a considerable time the Department had taken every opportunity of submitting to architects the advantages of electricity for large-scale heating, but while they were prepared to concur as to the advantages claimed for electricity (such as making possible a cleaner atmosphere, abolition of the need for flues and chimneys and the economical and convenient planning of buildings) the primary consideration in most cases was the cost of the operation of the electrical apparatus. If the Department were to secure and retain the load, the charge for electricity should be such as to enable it reasonably to compete with other forms of energy. The present flat rate for heating and cooking was ½d. per kWh, and in order to enable the Department to develop this load it was suggested that in cases where the consumer was prepared to guarantee a consumption of not less than 100,000 kWh per annum for heating and cooking purposes the tariff for such supply should be ¾d. per kWh during the two summer quarters. Although this might involve a loss of revenue of approximately £300 per annum at the beginning, the Committee believed that the tariff was a sound commercial proposition and would be valuable in securing new business.

Mains are to be extended by the Electricity Committee at a cost of £4,794, and sanction has been obtained to borrow £7,272 for substation equipment at the new town hall. Lighting is to be improved in York Road (£2,526), and in Park Street (£1,205).

Maidstone.—EXTENSIONS.—Houses at Barming, East Farleigh and Bearstead are to be supplied with electricity, and a h.v. main, with kiosk and transformer, is to be provided by the Town Council at a cost of £1,750 to supply a new bakery in Chatham Road.

Marlborough. — LOAN. — Application has been made by the Town Council for a loan of £9,240 in connection with the change-over.

Middlesbrough.—COMPETITIVE QUOTATIONS FOR STREET LIGHTING.—Consideration has been given by the Watch and Licensing Committee to the street lighting of the town. It was decided that when the extension of the lighting had been authorised the gas manager and the electrical engineer should be asked to submit quotations for lighting all main roads by gas and electricity respectively.

LOAN.—Application is to be made by the Town Council for sanction to borrow £6,280 for electrical equipment.

Newcastle-upon-Tyne.—CHANGE-OVER TO THE GRID.—The City Council has completed the process of changing over its system from local generation to a supply from the grid. The Manors power station, which has been in use thirty years, is now to be used as a sub-station.

Electricity for L.C.C. Houses

WHEN the London County Council constructed its housing estates at Downham and Bellingham all the houses were equipped for lighting and cooking by gas only, and similar arrangements were made for a large part of the Council's Becontree estate. On these three estates there were in all some 20,000 houses, built since the war, which were without an electricity supply. As a result of recent negotiations, however, local electricity undertakings have agreed to lay mains throughout the areas concerned, the Council agreeing to wire the houses for electric lighting, together with a number of power points. In certain areas the principle adopted was to canvass the tenants and to wire only those houses in which there was an immediate demand for electric lighting. It is interesting to note that this canvass showed that 80 per cent. of the tenants favoured the proposal.

In all new houses the Council adopts the conduit system of wiring, the conduit being concealed behind the plaster. Where houses are already built this is not practicable, and in such cases both lead-covered and tough rubber-sheathed cables are being used, concealed so far as practicable in the ceilings and roof voids, the only visible portions being those leading to switch drops and plugs. All lighting wiring is 3/029, and there is a generous number of points. Insulated switches are used throughout, and in the kitchen, which also serves as a bathroom, a ceiling switch is provided. The utility wiring is 3/036, terminating in 10-A switch plugs, each circuit being protected by separate 10-A fuses in the switch splitter.

As already stated, a supply of gas is available in all these houses for both lighting and cooking. The Council is now wiring for lighting only (with utility plug points), as it is felt that the question of electric cooking must be left to the initiative of the supply authority. In one large area the authority is not prepared to hire cookers; in others where electric cookers can be obtained on hire terms a certain number have already been installed.

Various methods are being adopted to bring the supply into the house, dependent largely upon the assistance which the supply authority is prepared to give. In one area the undertaking brought a free service into every house, thus making the subsequent development of electric cooking a simple matter. In another area the authority was only prepared to bring one free service to each block of houses, leaving the Council to run the necessary subservices to the other houses in the block. These subservices are being run in conduit in the roof space, looping in to service positions in the upper landing of each house. The number of houses in a block varies, but as many as six houses may thus be fed from one service. While this system is economical for the present purpose, *i.e.*, lighting, it has the disadvantage that it will restrict the authority at a later date if a demand for electric cooking arises. Another method, and possibly the best, is to bring one service to each pair of houses, the service terminating at a suitable position on the ground floor so that the service cut-outs for the two houses can be mounted back to back on the party wall. This method is economical in first cost and allows for future cooking developments.

The work of wiring the houses is well in hand. Contracts are being let for groups of houses varying in number from 300 to 800. It is intended to spread the letting of contracts in such a way that the whole of the work will be completed in between two and three years. It may be of interest to note that electric cookers are in use throughout the whole of the Council's Ossulston estate, King's Cross; throughout several blocks of the Lilestone estate, St. Marylebone; and in part of the Castelnau estate, Barnes. All new houses and flats, including those now under construction, are wired for electric lighting and power.

Nottinghamshire. — Teaching Electric Cooking. — The County Education Committee has decided to install five or six electric cookers each year in school centres.

Penarth.—Council Decides to Acquire Undertaking.—The Town Council has decided to take over the local electricity undertaking owned by the Penarth Electric Lighting Company, Ltd. No payment in respect of goodwill has to be paid by the Council. Last year the undertaking showed a profit of £9,320, after management expenses and the payment of income-tax had been met, and for each year since 1924 a dividend of 7½ per cent. has been declared on the ordinary shares. The total capital expenditure of the company is £116,253, while the reserve fund amounts to £72,420. The issued capital is £45,937, of which £30,000 is represented by shares. By arrangement with the Cardiff Rural District Council the undertaking provides supplies for the Lavernock and Sully districts.

Ross-shire.—Overhead Line.—The Ross-shire Electric Supply Co. has applied to the Board of Trade for consent to erect an overhead h.v. line across the entrance channel of Loch Fleet, in order to extend the supply from Dornoch to Golspie.

Rumania.—Projected Hydro-electric Power Station.—The National Institute for the Study of the Utilisation of the Power Resources of Rumania has recently issued a booklet outlining a scheme for the establishment of a hydro-electric station to utilise the power of the River Sireth drawn up by Herr V. Start. Working under a head of 270 ft. it is anticipated that about 13,000 kW would be available.

Sheringham.—Lower Charges.—The East Anglian Electric Supply Co. has reduced the charge for lighting in its area to 9d. per kWh.

Stoke-on-Trent.—All-electric Flats.—Electric water-heaters, cookers, fires, refrigerators and a modern system of electric lighting are being provided in new flats for professional men which are being erected at the Hill Farm estate.

Turkey.—Electricity Output.—The report of the Société Turque de l'Electricité, Istanbul, for the last financial year shows that the output of power during 1935 amounted to a total of 103 million kWh as compared with 99 million kWh during the preceding twelve months, and that the number of consumers increased during the year from 92,455 to 97,452.

Westmorland.—Objection to Overhead Line.—The Rural District Council is objecting to the extension of the grid line to Staveley in order to give a bulk supply to the Windermere & District Electricity Supply Co., Ltd.

Traction

Bath.—Control of the Tramway Undertaking.—It was decided at a recent Council meeting not to purchase the tramway undertaking.

London.—Traffic Control.—Automatic vehicle actuated traffic signals were brought into use last week at the junction of Northumberland Avenue with the Embankment, and the junction of Stamford Street with Blackfriars Road.

Salford.—Opposition to Trolley-bus Service Withdrawn.—The Corporation has decided to withdraw its opposition to the proposal of the Manchester Corporation to run trolley-buses along Deansgate, the necessary safeguards having been negotiated in respect of the Salford trams.

Tyneside.—Electrified Line Improvements.—An engineering work of some magnitude will be undertaken on the Tyneside electric lines of the London and North Eastern Railway during the week-end of May 22nd to 25th, when the conductor rail will be moved 3¼ inches throughout the whole length of the electric system totalling 80 miles of track. The Tyneside lines were electrified in 1904, and were among the first surface railways to be converted to that form of traction. A new position of the conductor rail has been selected as being more convenient for operation; this has been adopted as a national standard for all future electric lines, and the L.N.E.R. has been pressed by the Minister of Transport to convert its existing electric lines. The work on the track will be undertaken by a special organisation of 500 men taking up and relaying 80 miles of steel conductor rails weighing from 80 to 120 lb. per yard; 50,000 insulators have to be moved to new sites and continuity track cables altered in position. The company has recently resolved to extend the Tyneside system by electrifying the Newcastle to South Shields section, and in addition it has ordered over 130 new electric carriages in replacement of the existing stock of which a number of the newer carriages are to be completely reconditioned.

United States.—Railless Trolley Vehicles.—According to the *Electrical World* there are now 648 railless trolley vehicles in service in the United States, while vehicles now on order will raise the figure to at least 750. The leading city in this respect is Chicago, which has 120 vehicles in operation; Indianapolis follows with ninety-five. Our contemporary points out that the American "transit load" now amounts to about 5,000 million kWh annually, which is 26 per cent. less than in the peak year 1927. The railless trolley vehicle will conserve this load to the power companies. It is estimated that each vehicle requires about 120,000 kWh per annum, yielding a revenue of from $1,000 to as much as $1,400. The example of Great Britain in the use of these vehicles is referred to, and it is shown that they have many attributes which should lead to their adoption in increasing numbers in the United States.

Communications

Burma.—Radio Telephony.—A *Reuter* message from Rangoon states that the new beam radio station at Mingaldon is nearly completed. The station establishes communication with Madras across the Bay of Bengal and thence to London by direct overseas services. The important towns in Burma are connected with Rangoon by trunk telephone lines.

Canada.—Proposed Reform of Broadcasting Service.—A *Reuter* message from Ottawa states that the reorganisation of the administration of the Radio Broadcasting Company of Canada and the replacement of the present Radio Commission by a public corporation with a board of nine directors and a broadcasting expert as general manager, was suggested to the Dominion House of Commons Radio Committee by the Canadian Radio League recently. The committee is making a thorough study of the radio broadcasting situation in Canada, and will report to the Commons in the next few weeks.

China.—Long-distance Telephonic Communication.—A long-distance telephone service has lately been inaugurated between Shanghai and Pangpu, in the Province of Anhwei, a distance of about 300 miles. The service forms part of a new provincial telephone network which is approaching completion.

Great Britain.—Telephone Cables Damaged.—Some delay was caused this week by damage to two Anglo-Continental submarine cables, one of which was completely severed.

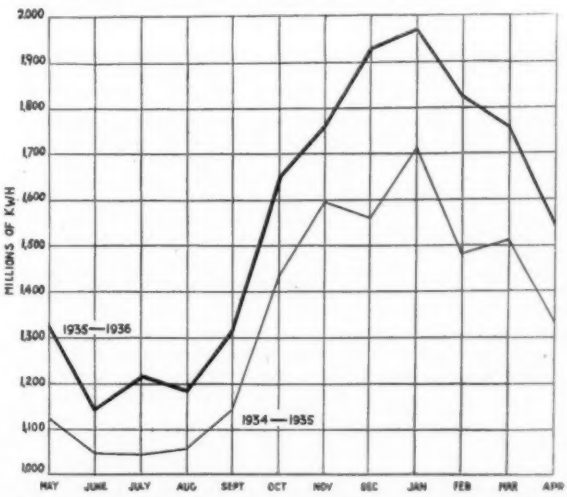
Irish Free State.—Telephone Extensions.—It is reported that the Dublin telephone exchanges are virtually fully subscribed, and congestion is likely to arise when the reduced charges come into force this summer. A new automatic exchange is therefore being built at the Crown Alley premises of the Post Office.

Jamaica.—Radio-telephone Service.—Kingston, Jamaica, is now linked with the United States by radio-telephone, states *Telegraph and Telephone Age*. Short-wave stations of the Bell system at Miami, Florida, working with stations of the Direct West Indies Cable Co. at Kingston provide the service.

Norway.—Marine Radio.—Following a rapid growth of radio installations in fishing vessels during recent years, plans have been made for a regular service of ship-to-shore communication. Norwegian authorities have decided to build three new coastal 'phone transmitters, *viz.*, one in Aalesund, one in North Norway (probably Finnmarken), and one in South Norway. These broadcasting stations will be devoted solely to keeping in touch with fishing vessels, and will serve as a medium to maintain constant ship-to-shore communication. The new system is later to be extended on a much larger scale, so that eventually the whole Norwegian coastline will be covered by short-range receiving and transmitting stations. Thus ships off the Norwegian coast will be able to call up any telephone subscriber in the country.

Generation of Electricity in April

THE official returns rendered to the Electricity Commissioners show that 1,554 million kWh of electricity was generated by authorised undertakings in Great Britain during April, as compared with the revised figure of 1,330 million kWh in the corresponding month of 1935, representing an increase of 224 million kWh, or 16.8 per cent. The number of working days in the month (*i.e.*, excluding Sundays and Bank Holidays) was 24, the same as last year.



The output of authorised undertakings in the twelve months to the end of April last, with comparative curve for 1934-35

During the first four months of 1936 up to the end of April the total amount of electricity generated by authorised undertakings was 7,101 million kWh as compared with the revised figure of 6,030 million kWh for the corresponding period of 1935, representing an increase of 1,071 million kWh or 17.8 per cent.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Ashbourne.—May 16th. R.D.C. Contract No. 3 for the Hartington water supply: Pumping machinery comprising two electrically driven borehole pumps (5,000 gal. per hr. each) and two electrically driven horizontal turbine type booster pumps (2,500 gal. per hr. each) with steel pressure tanks and automatic pressure control. Elliott & Brown, Burton Buildings, Parliament Street, Nottingham (deposit £3 3s.).

Australia.—MELBOURNE.—June 17th. State Rivers and Water Supply Commission. One 1,250-kW steam turbo-alternator with condenser, &c. (T.Y. 30111.)*

June 8th. State Electricity Commission of Victoria. Steel reinforced aluminium conductors and accessories. (See this issue.)

July 20th. Compound-filled switchgear and accessories. (T.Y. 30156.)*

Bathgate (WEST LOTHIAN).—Town Council. Various works, including electrical, at 114 houses. Town clerk, Borough Chambers, by May 18th.

Beckenham.—May 25th. Borough Council. L.v. p.i. cables for the period from July 1st, 1936, to March 31st, 1937. (See this issue.)

Birmingham.—May 20th. Electric Supply Committee. Cable jointing for the period from July 1st, 1936, to June 30th, 1937. (May 8th.)

Blackpool.—May 25th. Fylde Water Board. Diesel engines (and alternatively water turbines), 15-kW generators and switchgear at the Grizedale reservoir, Garstang. G. F. Atkinson, engineer, Sefton Street (deposit £1 1s.).

Cannock.—May 25th. U.D.C. Thirteen miles of 3-phase, 11-kV overhead line and pole mounting transformers and switchgear. (May 8th.)

Carlisle.—June 3rd. Electricity Committee. Alterations of the existing buildings at the Distribution Depôt and the erection of a large reinforced concrete structure. (May 8th.)

Cheadle and Gatley.—May 21st. U.D.C. Electricity Department. 6.6-kV and medium pressure switchgear and 350-kVA oil-cooled transformer with manually operated on-load tap changer. (May 8th.)

Coventry.—June 6th. Electricity Committee. One 30,000-kW turbo-alternator and auxiliary plant, two 150,000 lb./hr. water-tube boilers, auxiliary plant and buildings, and three ferro-concrete cooling towers and ponds. (May 1st.)

Dumfries.—May 28th. Electricity Department. One four-panel h.v. metal-clad switchboard and two 250-kVA transformers. (See this issue.)

Eccles.—May 18th. Electricity Supply Committee. Twelve months' supply of single-phase a.c. house service and prepayment meters. Borough electrical engineer, Electricity Offices, 1, King Street.

Edinburgh.—June 2nd. Corporation. Two steam generating units for the Portobello generating station. (May 8th.)

Egypt.—CAIRO.—July 1st. Ministry of the Interior. X-ray equipment. (T.Y. 30097.)*

Finchley.—May 25th. Borough Council. 200-kVA transformers. (May 8th.)

Gravesend.—May 23rd. Corporation. L.v. overhead lines in the Northfleet district. (May 8th.)

Halifax.—June 1st. Light, Heat and Power Committee. Replating of a 300-Ah battery and supply of a battery charging motor generator, switchgear and battery switchboard. (May 1st.)

May 18th. Housing Committee. Various works, including electrical, at forty houses on the Pellon New Road housing estate. D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £2 2s.).

May 23rd. Education Committee. Electric lighting at Parish Church mixed school and Mixenden school. D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £1 1s.).

Hastings.—May 28th. Borough Council. One switch and transformer kiosk with oil circuit-breakers. (May 8th.)

Heywood.—May 19th. Electricity Department. Cable, two transformers with "off-load" tap-changing equipment and one six-panel, 6,600-V switchboard. (May 8th.)

Kirkcaldy.—May 29th. Borough Council. L.v. and 6.6-kV cables, distribution boxes and trench excavation. (See this issue.)

Leeds.—May 18th. Housing Committee. Electrical installation in 1,552 houses on the Gipton estate. (May 8th.)

Lichfield.—May 21st. City Council. Cable, meters, wooden poles, conductors, and street-lighting lamps for the period ending March 31st, 1937. (May 8th.)

London.—BETHNAL GREEN.—May 21st. Borough Council. H.v. and l.v. switchgear and transformers. (May 8th.)

Manchester.—May 20th. Electricity Committee. Weldless steel lamp columns and fittings for year ending August 31st, 1937. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

Mexborough.—May 20th. U.D.C. H.v. switchgear and 1/3-phase, 10,000/400-V transformer. (May 8th.)

Middlesbrough.—May 25th. Electricity Department. Conductors and cable. (See this issue.)

Morecambe and Heysham.—May 28th. Borough Council. E.h.v. feeder cables, excavation and laying. (See this issue.)

Newark-on-Trent.—May 25th. Borough Council. One steel switch and transformer kiosk and 150-kVA transformer. (May 1st.)

New Zealand.—WELLINGTON.—June 2nd. Public Works Department. One motor-generator set and one copper-oxide rectifier unit. (T.Y. 30096.)*

June 15th. Government Railways Administration. Machine tools and electric overhead travelling crane. (T.Y. 5788.)*

Northern Ireland.—BELFAST.—May 30th. Electricity Committee. 30,000-kV turbo-alternator plant with auxiliaries and pipework. (May 8th.)

Norwich.—Corporation. Boiler feed and circulating water pumps, &c., and 6,600-V 3-phase switchgear, &c. (May 8th.)

Peterborough.—May 22nd. Public Assistance Committee. Two-compartment refrigerator (175-c. ft. capacity) at the P.A. Institution, Thorpe Road. W. J. Deacon, clerk of the County Council, County Council Offices, Bridge Street.

Portsmouth.—May 19th. Electricity Department. Lining and repairing existing steel bunkers at the generating station, Gunwharf Road. (May 8th.)

Preston.—July 7th. Electricity Department. House service type electricity meters, domestic water-heating apparatus and breakfast cookers. (See this issue.)

Seaham Harbour.—U.D.C. Electric cable. J. S. Forster, electrical engineer, "Electric House."

Sheffield.—June 1st. Electricity Committee. Two water-tube h.v. steam boilers with associated equipment for the Blackburn Meadows generating station. (May 1st.)

Sleaford.—May 19th. U.D.C. L.v. cables and a.c. and d.c. meters for twelve months and l.v. distribution mains and equipment. (May 8th.)

Slough.—May 27th. U.D.C. Two groups of pumping plant with motors, pipe connections, valves, switchgear, &c., and appurtenant works at two pumping stations. G. B. Kershaw & Keufman, 9, Victoria Street, London, S.W.1 (deposit £5).

South Africa.—JOHANNESBURG.—May 26th. Railways and Harbours Administration. Thirteen 4-ton level luffing electrically driven portal jib cranes. (T.Y. 30012.)*

PRETORIA.—June 5th. Public Works Department. Electric lighting fittings. (T.Y. 30166.)* Three electric lifts. (T.Y. 30165.)*

June 12th. Union Tenders and Supplies Board. Stationary batteries. (T.Y. 30168.)*

South Shields.—June 8th. Corporation. Electrical fittings and lamps for the six months ending December 31st, 1936. (See this issue.)

Staffordshire.—May 19th. Potteries Water Board. Two sets of electrically operated rotary pumps with electric control, cables, &c. P. Wilkinson, engineer to the Board, Albion Street, Hanley (deposit £5).

Tottenham.—May 25th. Education Committee. Electrical installation in the Downhills, Belmont, Parkhurst and Crowland Road elementary schools. (May 8th.)

Wallasey.—May 25th. Borough Council. Seven switch pillars for a single-phase, 50-cycle, 2,200-V system. (May 1st.) H.v. and l.v. p.i. cables and house service meters during year ending June 30th, 1937. (May 8th.)

Walsall.—May 18th. Walsall and West Bromwich (Barr Colony) Joint Board. Electrical installations at extensions of the Barr Colony. Edwards & Shaw, 105, Colmore Road, Birmingham, 3 (deposit £3 3s.).

Walton and Weybridge.—May 20th. U.D.C. Electricity Department. Twelve months' supply of l.v., p.i., l.c. and s.t. armoured cables. (May 8th.)

Worksop.—May 18th. Town Council. Two electrically operated vertical-spindle centrifugal pumping units to lift 2,000 gal. per minute each against a total head of 260 ft. C. O. Allsopp, borough engineer, Town Hall (deposit £4 4s.).

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Australia.—SYDNEY.—County Council. Accepted. 650,000 yd. of double-braided weatherproof cable (£5,204).—British General Electric Co., Ltd.

VICTORIA.—State Electricity Commission. Accepted. 135,000-V switchgear and accessories for the Yallourn power station and the Richmond terminal station (£12,320).—Brown, Boveri & Co. 22,000-V, 750,000-kVA compound-filled feeder circuit-breaker unit.—A. Reyrolle & Co. 25,000-kW turbo-generator (£88,103).—Met.-Vick Elecl. Co. Drums for four boilers at the Yallourn power station (£5,843).—Thompson Water Tube Boilers, Ltd.

Victorian Railways. Accepted. 300 yd. single-core copper conductors (£298).—Henley's.

Melbourne City Council. Accepted. Cable.—Henley's (£592); B.I. Cables (£851); Johnson & Phillips (£585); Enfield Cable Works (A'sia), Ltd. (£4,250). H.v. armour-clad switchgear (£18,525).—A. Reyrolle & Co.

COMMONWEALTH.—P.M.G.'s Department. Accepted. Tools (£209) and transmitters and parts (£705).—Automatic Telephones, Ltd. Switchboard cords (£185).—Standard Telephones & Cables (A'sia), Ltd.—*Tenders.*

Cardiff.—Electricity Committee. Wilson electric vehicle (£353).—W. Lewis & Sons.

Dundee.—Town Council. Accepted. Electrical work at Beechwood housing estate.—Stenson & Co.

Dunfermline.—Town Council. Accepted. Electrical installations in 427 houses at Brucefield, Whirlbut, Milton Green and Townhill.—Miller & Stables.

East Ham.—Electricity Committee. Accepted. Switchboard (£172).—New Switchgear Construction Co.

Hastings.—Electricity Committee. Recommended. Fire protective apparatus for power station (£404).—Walter Kidde & Co.

Hull.—Education Committee. Accepted. Electrical installation at Cavendish Road school (£355).—Booker & Tarran.

Ipswich.—Electricity Committee. Accepted. Battery for power station (£909).—Alton Battery Co.

Leeds.—Housing Committee. Accepted. Electrical installations at the Belle Isle housing estate (£4,295), the Hawksworth housing estate (area No. 4) (£252) and the Torre housing estate (£171).—F. Marshall Co. (Electricians).

Baths Committee. Accepted. Lighting alterations at Victoria Hall (£135).—Sun Electrical Co.

Electricity Committee. Accepted. Cables.—Henley's (£1,338); Edison Swan Cables (£1,311); Enfield Cable Works (£692); Macintosh Cable Co. (£630); Derby Cables (£1,461); Telegraph Const. & Maint. Co. (£703); Hackbridge Cable Co. (£432); Metropolitan Electric Cable and Const. Co. (£193).

Transport Committee. Accepted. Transformer repairs (£272).—Met.-Vick. Elecl. Co.

Liverpool.—Electric Power and Lighting Committee. Accepted. 6,000-V metal-clad switchgear at the Marsh Lane (£6,556) and Smithdown Road (£7,463) sub-stations.—Switchgear & Cowans, Ltd.

London.—L.C.C.—Wiring and fittings for electric lighting, &c., in one block of dwellings (Peterhead House) on the East Hill estate (Didcot Street area), Battersea:

	£		£
Carr Bros., Accepted	**964**	E. W. Merredew	1,276
Pemberton and Sturgess (Great Britain), Ltd.	1,000	Arthur Cozens	1,405
E. and C. Champion	1,093	B. C. Bullard and Co.	1,496
Davis Myer and Co.	1,188	Freeman Electrical Co.	1,769

Housing and Public Health Committee. Wiring and fittings for electric lighting, &c., in 800 existing houses and flats, &c., at Becontree (Dagenham area, No. 7 contract):

	£		£
Ilford Electrical Co. Accepted...	**7,877**	A. Higginbotham & Son ...	9,857
Evans and Shea...	8,014	Bower Eng. Works (Electrical and General)	10,144
Springvale Electrical Co. ...	8,639	Francis Polden & Co.	10,250
Ryland's Electrical Co. ...	8,679	S. Reed & Sons	10,261
G. E. Taylor & Co.	9,039	Troughton and Young, Ltd. ...	10,427
Electrical Installations, Ltd. ...	9,503	Henfrey Electrical Installations	10,519
Read and Partners, Ltd. ...	9,708	Smith and Hammond, Ltd. ...	12,432
W. H. Gaze & Sons	9,711	Harland and Wolff, Ltd. ...	12,666
A. Hawkins & Sons	9,748	The chief engineer's comparable estimate is £9,097.	
Anderson, Angell & Co. ...	9,776		
Ellis and Ward, Ltd.	9,784		

Middlesbrough.—Town Council. Accepted. Four circuit-breakers (£145).—English Electric Co.

New Zealand.—Public Works Department. Accepted. For the Mangahao scheme: Outdoor steelwork and switchgear.—British General Electric Co. Switchgear.—A. Reyrolle & Co. Geared electric motors.—Asea Electric, Ltd.—*Tenders.*

Stoke-on-Trent.—Assistance Committee. Accepted. Cable renewals at the London Road Institution (£236).—Callender's.

Electricity Committee. Accepted.—Overhead transmission lines.—Callender's. House-to-house services.—E. Holloway.

Tunbridge Wells.—Town Council. Accepted. 85-h.p. motor for a boiler fan (£274).—B.T.H.

Wallsend-on-Tyne.—Town Council. Accepted. Internal telephone system, comprising twenty-one instruments, at the Town Hall (£355).—Telephone Rentals (Northern).

Forthcoming Events

Institution of Electrical Engineers (*London Students' Section*).—Friday, May 15th. Institution, London, W.C.2. 7 p.m. Annual general meeting. Saturday, May 16th. 2.30 p.m. Visit to Messrs. J. & E. Hall, Ltd., Dartford. Friday, May 22nd. 6.30 p.m. Visit to the High-voltage Laboratories, Queen Mary College, E.1.

Transmission Section.—Friday, May 15th. Summer visit.

Irish Centre.—Thursday, May 21st. 1, Foster Place, Dublin. 3 p.m. Annual general meeting.

Western Centre.—Friday, May 22nd, to Monday, May 25th. Abernant Lake Hotel, Llanwrtyd Wells, Central Wales. Summer meeting.

Physical Society.—Friday, May 15th. Imperial College of Science and Technology, London, S.W.7. 5 p.m. Twenty-first Guthrie Lecture by Prof. F. A. Lindemann.

Electrical Power Engineers' Association (*North-West England Sections*).—Saturday, May 16th. Municipal Buildings, Southport. 3 p.m. Joint general meeting. Address by Mr. H. S. Smith.

Junior Institution of Engineers.—Tuesday, May 19th, and Wednesday, May 20th. E.L.M.A. Lighting Service Bureau, London, W.C.2. 9.30 a.m. Conference on electric lighting in work and offices. Friday, May 22nd. 2.30 p.m. Visit to the Associated Equipment Co., Southall.

Association of Mining Electrical Engineers (*South Wales Branch*).—Wednesday, May 20th. Speech House Hotel, Forest of Dean. Annual meeting. Visit to the cable works of the Edison Swan Electric Co., Lydbrook.

Institution of Railway Signal Engineers.—Wednesday, May 20th. Institution of Electrical Engineers, London, W.C.2. 5.30 for 6 p.m. "Electro-Pneumatic Signalling." Mr. R. S. Proud. Friday, May 22nd. 6.15 p.m. Inspection of new power signalling installation, Fenchurch Street Station, London, E.C.

Institute of Transport.—Wednesday, May 20th, to Saturday, May 23rd. Queen's Hotel, Birmingham. Annual congress.

Scottish Centre.—Monday, May 18th. North British Station Hotel, Edinburgh. 7.15 p.m. Annual general meeting

Notes

The Electrical Engineers' Ball

We are pleased to record, on the authority of the Committee of Management of the Benevolent Fund, that the Fund has benefited to the extent of £230 odd, the amount of the surplus available after defraying all the expenses of the Ball held on February 14th. The attendance was over 1,050.

The Electrical Association for Women

The recently formed High Peak Branch held its first meeting on April 29th, with Mrs. Watson-Ingram in the chair. Mr. R. C. Hawkins, of E.D.A., spoke on "What every woman ought to know about electricity." On May 6th a party of nearly seventy members of the Birmingham Branch visited the works of Messrs. J. H. Tucker & Co., Ltd., Tyseley. At the tea which followed Mr. J. B. Tucker, chairman of the company, mentioned the progress now being made by manufacturers in simplifying the use of electrical appliances by standardising the essential features of such apparatus as plugs, sockets, lampholders, &c.

Electricity's help towards freeing women from the drudgery of housework was emphasised by Miss C. Haslett, director of the Electrical Association for Women, at the inaugural meeting of the Crewe branch of the Association last week. The Mayor, Mr. H. Jones, presided over a good attendance, and the following officers were elected: President, Dr. A. Parkes; vice-presidents, the Mayoress (Miss H. Jones) and Mrs. E. Thewlis; chairman, Mrs. A. D. Hegan; joint secretaries, Mesdames A. Jones and Nunn; treasurer, Mrs. Staton.

Explosion in an Operating Theatre

At the inquest relating to the death of a patient as a result of an explosion in the operating theatre at Middlesex Hospital, evidence was given by Mr. H. W. Swann, Electrical Inspector of the Home Office, regarding the condition of the connections of the 8-V transformer-fed lamp attached to the surgical instrument employed. He had found some of the strands in the flex of the connector broken which might cause sparks. The defect was probably due to manipulation and would not be visible externally.

The coroner, recording a verdict of accidental death, stated that the explosion (which resulted in a wound in the throat leading to bronchial pneumonia through inhalation of blood) was the effect of a spark from the surgical lamp on the mixture of gas, oxygen and ether used as an anæsthetic.

A Transdanubian 60-kV Transmission Cable

In a recent issue of our Hungarian contemporary *Elektrotechnica*, Herr Jozsef Frohner describes a 60-kV power transmission line which has been erected across the River Danube at Ercsi, about twenty miles from Budapest. The line comprises three steel cables each of nineteen wires having a diameter of 2.5 mm., the utilisable section of each conductor being 95 sq. mm. There is a difference of 89 ft. between the heights of the river banks. On one side the three cables are supported on a single mast 139 ft. high, and on the other on three 50-ft. masts. The span measures 1,882 ft. and the height of the cables above the water is 69 ft. Owing to the prevalence of hoar frost in cold weather the cables have been designed to carry an extra weight of 7½ lb. per metre. Provision has been made for the removal of the hoar frost by heating the cables. Although intended for 60 kV, they are at present being used only for 22 kV.

Appointments Vacant

Sub-stations engineer for Plymouth Electricity Department.

Senior assistant electrical engineers for the North-Eastern Electric Supply Co., Ltd.

Meter mechanic for the Perth Electricity Department.

Lecturer in charge of instruction in instrument making at the Northampton Polytechnic, E.C.

Senior lecturer and demonstrator (female) for York Electricity Department.

Installation inspector for East Retford Electricity Department.

Assistant constructional engineer for Birmingham Electric Supply Department.

Assistant mains engineer for King's Lynn Electricity Department.

Assistant electrical foreman for the Public Works Department, Government of Gambia.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

LUNBAR towel airers.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. H. L. Guy, chief engineer of the Mechanical Department of the Metropolitan-Vickers Electrical Co., Ltd., has been elected a Fellow of the Royal Society. Mr. Guy's work in connection with many problems in applied thermo-dynamics and the technical aspects of steam turbine and condenser design is well known, and his technical ability has been frequently recognised. Last year he was invited to join the Advisory Committee for Metallurgical and Engineering Research on materials of the National Physical Laboratory; in 1927 he received the Hawksley Gold Medal, the highest award of the Institution of Mechanical Engineers. Since 1928 he has been a member of the Council of this Institution. He has on three occasions been invited to act on the British Delegation to the International Steam Tables Conference, and is a member of the Research Committee of the Institution of Civil Engineers.

Mr. H. L. Guy

Dr. J. D. Cockcroft, whose work in atomic physics has recently brought him prominently into the public eye, has also been made a Fellow of the Royal Society. After taking his degree at the Manchester College of Technology, he joined the Metropolitan-Vickers Research Department in 1920, and was employed there until 1923. He then went to the Cavendish Laboratory at Cambridge, where he has worked on the disruption of the atom in collaboration with Dr. Walton. Dr. Cockcroft still acts in an advisory capacity to the M.-V. Laboratories and keeps in close touch with the developments in apparatus which take place there. On April 23rd he delivered the twenty-seventh Kelvin Lecture before the Institution of Electrical Engineers, an abstract of which was published in our issue of May 1st, together with Dr. Cockcroft's portrait.

Mr. A. J. Hedgcock, who has retired from the position of chief engineer, Contracts Department, W. T. Henley's Telegraph Works Co., Ltd., was presented on May 6th before a large assembly in the company's social room, with a half hunter gold watch, a set of golf clubs, and a dressing table set in blue enamel for Mrs. Hedgcock. The presentation was made on behalf of the staff by Sir Montague Hughman, chairman of the company, who said that Mr. Hedgcock joined Henley's in 1904, and had travelled all over the world on its behalf. He wished him many years of health and happiness in his retirement. Mr. Hedgcock suitably responded.

The presentation to Mr. A. J. Hedgcock
Left to right: Mr. E. Lefeaux, Mr. A. H. M. Jacob, Sir Montague Hughman, Mr. A. J. Hedgcock and Mr. J. E. H. Colyer

Mr. Hedgcock served his apprenticeship in the Portsmouth Dockyard, and for two years was engaged in the electrical department. In 1891 he joined the Silvertown Company and installed the complete electrical equipment in the cruisers *Blenheim*, *Grafton* and *Thesius*, built by the Thames Iron Works at Victoria Docks. When he joined the City of London Electric Lighting Co. in 1892 the only mains used were bitumen or rubber cables. He laid the first lead-covered, paper-insulated cable in the City of London in 1893. During his long service with Henley's Mr. Hedgcock was responsible for many important contracts, including the high-voltage cable work for the London United Tramways, the electrification of the Central Argentine and Buenos Aires Pacific Railways, the laying of 33,000 V cables for the Commonwealth Edison Co. in Chicago, and the laying of the telephone cables from Port Said to Suez for the Eastern Telegraph Co. He often accompanied the late Sir George Sutton to Norway and other overseas countries in connection with contract work.

Mr. R. P. Sloan has resigned from the board of the Shropshire, Worcestershire & Staffordshire Electric Power Co.

Mr. E. H. Miller, of the British Sangamo Co., Ltd., was elected chairman of the Enfield District Manufacturers' Association for the ensuing year at the annual meeting and dinner of the Association held on May 8th. Mr. Miller has served on the Committee for the past four years.

Mr. E. H. Miller

Eccles Town Council has placed **Mr. W. Ashton,** mains superintendent, on superannuation as from May 31st, and has appointed **Mr. A. H. G. Burbridge,** assistant mains superintendent, as his successor.

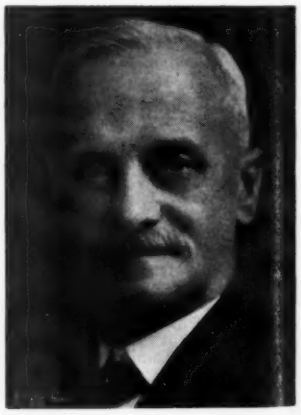
Mr. S. F. Steward has been appointed sales manager to Bull Motors. He has been associated with the company for fifteen years, and during that time has occupied the appointments of designer and sales engineer.

Mr. R. C. Lyons, Manchester representative of Messrs. Allen West & Co., Ltd., who has been ill for some considerable time, has now recovered and has resumed his duties.

Mr. F. Garside, of Basingstoke, has been appointed assistant mains engineer to the Reigate Town Council at a salary of £300 per annum, rising to £400.

Mr. A. T. Eardley, the retiring general manager of the Stockport Tramways Department, has been presented by his colleagues with an inscribed case of cutlery.

Mr. J. Stirrup, A.M.I.E.E., consumers' engineer with the Liverpool Corporation Electricity Department, has completed fifty years' service, and on May 8th he was chief guest at a staff dinner of the Electricity Department held at the Bear's Paw Restaurant, Liverpool. There were about 160 present, and the toast of Mr. Stirrup's health was proposed by Mr. P. J. Robinson, the city electrical engineer, supported by Mr. E. L. Morland, superintendent engineer of distribution, and Mr. L. Breach, chief electrical assistant. Ald. F. C. Wilson, chairman of the Electric Power and Lighting Committee, presented Mr. Stirrup with three water colours of the Lake District on behalf of the staff. Mr. Stirrup joined the Liverpool Electric Supply Co., Ltd., in 1886, at the time of the International Exhibition at Liverpool. In that year the number of men employed by the company was twenty-five, and the output was less than 250,000 kWh per annum. The undertaking now employs over 2,500, and has an annual sale of approximately 400 million kWh. Mr. Stirrup has held the positions of inspector of electric meters, superintendent of the Meter Department, and consumers' engineer.



[*Vanderbilt*
Mr. J. Stirrup

Mr. R. W. Gregory, consulting engineer, Carliol House, Newcastle-upon Tyne, has taken Mr. Duncan Adam into partnership. The firm will be known as "R. W. Gregory and Partner."

Dr. G. A. Campbell, the United States inventor, who, as recently recorded in the ELECTRICAL REVIEW, has retired from active membership of the staff of the Bell Telephone Labora-

tories, New York, has been awarded the 1936 Medal of Honour of the Institute of Radio Engineers.

I.E.E. Awards.—The Council of the Institution of Electrical Engineers has made the following award of premiums for papers read during the Session 1935-36, or accepted for publication :—Institution Premium : Messrs. W. L. McPherson and E. H. Ullrich. Ayrton Premium : Mr. G. H. Wilson, Lieut.-Commander E. L. Damant, and Mr. J. M. Waldram. Fahie Premium : Major L. H. Peter. John Hopkinson Premium : Messrs. D. R. Davies and C. H. Flurscheim. Kelvin Premium : Messrs. T. E. Allibone and F. R. Perry. Overseas Premium : Messrs. J. J. Rudra and D. J. Badkas, Mr. J. H. Sprawson, Mr. T. Varney. Extra Premiums : Messrs. G. A. Whipple, A. L. Whiteley, Dr. Russell J. Reynolds, Messrs. E. R. Kaan, B. G. Gates, E. T. Hippisley, A. C. Timmis, and R. Poole. Wireless Section Premiums.—Duddell Premium : Messrs. H. L. Kirke and A. B. Howe. Extra Premiums : Messrs. W. J. Brown and E. B. Moullin. Meter and Instrument Section Premiums.—Silvanus Thompson Premium : Mr. J. H. Buchanan. Extra Premiums : Prof. J. T. MacGregor-Morris, and Mr. R. M. Billington, Mr. J. S. Preston, and Messrs. G. A. Burns and T. R. Rayner. Transmission Section Premiums.—Sebastian de Ferranti Premium : Mr. D. Ross. Extra Premium : Mr. J. S. Forrest.

Obituary

Mr. H. W. Drake.—The death is reported in the *Telegraph and Telephone Age* of Mr. Herbert W. Drake, equipment engineer of the Western Union Telegraph Company and a native of Leeds, England. He was the responsible head of the engineering division that developed the facsimile, teletypewriter, and other important telegraph systems in America. Mr. Drake was in his fifty-eighth year.

Alderman T. J. Guppy, Deputy Mayor of Weymouth, died on May 3rd. He had been a member of the Electricity Committee for twenty-nine years, and chairman for the last twelve years. He was Mayor of Weymouth from 1914 to 1915 and again from 1933 to 1935. Alderman Guppy was also a member of No. 11 District Joint Industrial Council and of the No. 11 District Joint Board.

Mr. A. Lewis, electrical engineer and manager to the Adwick-le-Street Urban District Council, collapsed and died on May 9th.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

United Tube (Holdings), Ltd.—Public company. Registered May 2nd. Nominal capital, £532,000. Objects : To acquire the whole of the issued share capital of the British Mannesmann Tube Co., Ltd. ; to adopt agreements between (1) Mannesmannrohren Werke, of Dusseldorf, of the one part, and Stewarts and Lloyds, Ltd., Tube Investments, Ltd., and the company of the other part; (2) the Premier Steel Tube Company, Ltd., of the one part, and Stewarts and Lloyds, Ltd., Tube Investments, Ltd., and the company of the other part, and (3) Stewarts and Lloyds, Ltd., and Tube Investments, Ltd., of the first part, the company of the second part, and Mannesmannrohren Werke of the third part; to acquire and hold shares, stocks, debentures and securities; and to manufacture steel and iron, tubes of wrought iron, steel or other metal, iron and steel plates, sections and fittings, &c. The subscribers are : R. C. G. Clarke and C. H. Scott, both of 18, Austin Friars, E.C.2, and five others. Solicitors : Slaughter & May, 18, Austin Friars, E.C.2, and Maclay, Murray and Spens, 169, West George Street, Glasgow.

Franco Signs, Ltd.—Public company. Registered May 8th. Nominal capital, £200,000. Objects: To acquire the whole of the issued share capital of the Franco-British Electrical Co., Ltd., the Hewson Manufacturing Co., Ltd., Franco-Neon, Ltd., the Bell Manufacturing Co., Ltd., and Reflex Signs, Ltd. (formerly Franco Signs), Ltd.; to adopt an agreement with the Marquess of Milford Haven, C. A. L. Irvine, E. F. Harrison, H. Bay, A. H. Brackensey and the Franco-British Electrical Co., Ltd., and to carry on the business of gas, electrical and general engineers, makers of and dealers in illuminated and other signs, &c. The total purchase price of £199,997 is to be satisfied in shares. The directors are: The Marquess of Milford Haven, Lynden Manor, Holyport, Maidenhead; C. A. L. Irvine, Cripplegate House, Southwater, near Horsham, Sussex; E. F. Harrison, 100, Piccadilly, W.1; H. Bay, Franco Cottage, Bath Road, Maidenhead; A. H. Brackensey, 8, Arden Road, Finchley, N.W.; and J. F. Mallabar, 71, Piccadilly, W.1. The directors' borrowing powers are restricted to £300,000. Registered office: 25, Oxford Street, W.1.

Electrical Productions (Leeds), Ltd.—Private company. Registered May 6th. Capital, £1,000. Objects : To carry on the business of manufacturers of and dealers in electrical plant, apparatus, machines and accessories, &c. The directors are : F. Winder, 29, Gledhow Lane, Leeds, 8, and three others. Registered office : Hope House, Vicar Lane, Leeds.

Sterling Clock Co., Ltd.—Private company. Registered May 6th. Nominal capital, £100. Objects : To carry on the business of manufacturers of, agents for and dealers in electric and other clocks, chronometers and timepieces, &c. The subscribers are : T. S. Cornwell, 9, Wilson Road, Southend-on-Sea, and J. Ismay, Braemore Lodge, Sundridge Avenue, Bromley, Kent.

Finch & Goddard, Ltd.—Private company. Registered May 1st. Capital, £200. Objects : To acquire the business of an electrical and radio engineer now carried on by A. B. Finch at 87, Moss Lane, Alderley Edge, Ches, as "Arthur Finch." The directors are : A. B. Finch, 87, Moss Lane, Alderley Edge, Ches, and J. Goddard, 60, Lindfield Estate, Wilmslow, Ches. Registered office : 87, Moss Lane, Alderley Edge, Ches.

London & Provincial Electrical Co., Ltd.—Public company. Registered May 2nd. Nominal capital, £125,000. The objects are to adopt an agreement with W. J. Tyler for the purchase of the business of an electrical contractor and manufacturer, and to carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity and electrical appliances and apparatus, &c. The subscribers are : F. H. Shimmell, 16a, Glenfield Road, Balham, S.W.12, and six others. Solicitor : R. F. Rowland, 13, Ironmonger Lane, E.C.

Hipprum Wires, Ltd.—Private company. Registered May 7th. Capital, £5,000. Objects: To carry on the business of manufacturers of insulated wires and cables, telephone, electric, magnetic, galvanic, and other wires, &c. The subscribers are: J. Lord, 2, Albert Street, Hebden Bridge, Yorks; and R. Rawlinson, 43, The Gardens, Halifax. Secretary: R. Rawlinson. Registered office: Longmarsh, Hipperholme, near Halifax.

Bonnella Brothers (1936), Ltd.—Private company. Registered May 9th. Capital, £1,450. Objects: To carry on the business of electrical engineers, manufacturing electricians, manufacturers of, agents for and dealers in motor cars and all parts and accessories thereto, and apparatus and requisites for cinematograph theatres, &c. The directors are: A. Bonnella, 68, Monarch Court, Lyttelton Road, N.2 (permanent chairman); and W. Bonella, Alpine Croft, 66, Boundary Road, Charlton-on-the-Hill. Registered office: 11, Bucknall Street, W.C.2.

Pontet Insulation Co., Ltd.—Private company. Registered May 7th. Capital, £2,000. Objects: To acquire the business of the Pontet Insulation Co. carried on by A. J. Andrews, Ltd., at Duncombe Road, N. The directors are: H. C. Pontet, 76, Duncombe Road, N.19; and G. A. H. Andrews, 26, Lyttelton Court, Lyttelton Road, N.2. Registered office: 76, Duncombe Road, N.19.

Returns of Electrical Companies

East Anglian Electric Supply Co., Ltd.—The nominal capital has been increased by £190,000 in £1 ordinary shares beyond the registered capital of £450,000.

Premier Electric Heaters, Ltd.—The nominal capital has been increased by £50,000 beyond the registered capital of £50,000. The additional capital is divided into 50,000 5 per cent. non-cumulative preference shares of £1 each.

Ionlite, Ltd. (formerly Atomlite Signs, Ltd.).—Satisfaction in full on December 3rd, 1935, of four charges dated October 14th, 1932, December 12th, 1932, February 27th, 1933, and May 2nd, 1934, and registered October 15th, 1932, December 31st, 1932, March 4th, 1933, and May 15th, 1934, respectively, notice filed April 30th, 1936.

Cheshire Cables, Ltd.—Capital, £12,500 in 10,000 ordinary shares of 5s. and 10,000 preference shares of £1. Return dated December 31st, 1935 (filed March 17th, 1936). 8,002 ordinary and 9,949 preference shares taken up. £11,949 10s. paid. Mortgages and charges, nil.

Moulded Products, Ltd.—The nominal capital has been increased by £35,000 beyond the registered capital of £15,000. The additional capital is divided into 10,000 6 per cent. redeemable cumulative participating preference, 15,500 ordinary, and 9,500 unclassified shares of £1 each.

Switchgear & Cowans, Ltd.—The nominal capital has been increased by £60,000 beyond the registered capital of £40,000. The additional capital is divided into 240,000 shares of 5s. Each of the 40,000 shares of £1 in the original capital has been divided into 4 shares of 5s. each.

E. G. S. Co., Ltd.—Satisfaction in full on April 15th, 1936, of mortgage and further charge dated August 31st, 1931, and June 14th, 1932, and registered September 4th, 1931, and July 5th, 1932, respectively. (According to the register of mortgages, the mortgage and further charge registered September 4th, 1931, and July 5th, 1932, originally secured £25,000 and £7,000 and further advances respectively.)

Guy R. Fountain, Ltd.—The nominal capital has been increased by the addition of £4,500 beyond the registered capital of £6,000. The additional capital is divided into 700 6 per cent. cumulative preference and 3,800 ordinary shares of £1 each.

Electrical Inspection & Service Co., Ltd.—Capital, £250 in £1 shares. Return dated March 31st, 1936. 241 shares taken up. £241 paid. Mortgages and charges, nil.

Mitchell Electric Co., Ltd.—J. E. Talbot, of 5-11, Theobalds Road, W.C.1, was appointed receiver and manager on April 30th, 1936, under powers contained in debenture dated April 15th, 1936.

City Notes

Johnson & Phillips, Ltd., held their annual meeting on May 7th, Mr. G. L. Wates (chairman) presiding. In presenting the report and accounts (ELEC. REV., April 17th, page 585), the chairman said their turnover for the year under review had considerably increased, and this arose from the substantially large number of orders which had been booked and not from the higher values of individual orders. Comparing the figures of 1935 with those of 1932, which was the year in which they suffered most from the recent depression, the value and the number of orders booked had both increased by 63 per cent. The average value in money of individual orders booked from 1932 to 1935 inclusive did not vary by more than £1. The prices, however, were still very low and in many cases actually unremunerative. Their total profit had not increased in the same proportion as orders booked by reason of the low prices which persisted throughout 1935. This particularly applied to mains cables, in which the extreme competition for such business as was available during the years of depression following the national crisis of 1931 had driven the prices down to figures which were quite unreasonable. Fortunately, these low prices had been raised to a modest extent. The Transformer & Switchgear Departments had substantially increased their turnover, and they had commenced to make tanks required for those departments. Their water-heater business had progressed during the year, and they had concluded several important new contracts with supply authorities. Their Condenser Department continued to make good progress, the sales during 1935 being more than three times those of 1934. Many leading industrial consumers of electricity had installed their condensers during the year, both at home and abroad. They had sold many of them in India and were now engaged on a substantial contract for Australia. Their subsidiary company which manufactured "Permel" enamelled wire had continued to make progress and increased its turnover during the year. Owing to the marked fall in the selling prices of enamelled wire, however, the accounts for 1935 showed a small loss. The turnover of the Contract Department during 1935 was less than in 1934, partly by reason of a general temporary falling off in line erection work and partly because their own subsidiary companies had largely completed their mains network in 1934. This temporary setback had been more than made up in the early months of the current year, and the work in hand in the Contract Department to-day was much in excess of the corresponding figure for last year, or for many years past, and included approximately 100 miles of 132,000 V and 66,000 V steel tower lines for the Central Electricity Board. With regard to their subsidiary supply companies, these all advanced substantially both in kWh generated or purchased and in profits. It was in connection with the development of these companies that the bulk of the additional capital raised during last year had been employed. Their overseas business during 1935 had shown a marked increase in all countries in which they had branches or agencies. South Africa had again been prominent and had nearly doubled its turnover. They had every hope that the steady expansion during the last few years would continue during 1936. During the present year they would be spending further moneys on the development of their subsidiary companies.

In seconding the motion for the adoption of the report and accounts, Sir Philip Dawson briefly reviewed the electrical industry generally. He referred to the rapid increase in the output of public utility companies since 1929. From 1929 to 1934 the output increased by about 1,000 million kWh annually, but the increase last year was 2,000 million kWh. Sir Philip said that the general electrification of the suburban systems and densely crowded lines of our railways would give an enormous amount of work to the electrical and all allied industries.

The Calcutta Electric Supply Corporation, Ltd., held its annual meeting on Monday last when Lord Meston (chairman), who presided, said that although the difficulties of the jute trade continued, a turn towards general prosperity was perceptible in most of the industries in Calcutta. During the year under review 183,000,000 kWh was sold for h.v. power against 155,000,000 kWh for 1934, while the improvement in the consumption for l.v. power was also satisfactory. With regard to the domestic load the increase in sales from 44 to 46 million kWh was considered a somewhat disappointing response to the reduction in the domestic flat rate from 2¾ to 2½ annas per kWh at the beginning of the year, but it must be remembered that this reduction was more than counterbalanced in July last, when the new Government tax of half an anna per kWh was imposed, and they were required to add it to the bills. Referring to the Government Committee's inquiry into the company's domestic rate the gravamen of the charges brought against the company was that the dividends were too high; that the provisions for depreciation and obsolescence were excessive; that no further profits should be placed to general reserve; and that the consumers had not been given the relief which, with a dividend of 6 per cent. and economies in every direction, the company could afford. The Committee's report was in many respects a gratifying document, but it recommended a number of drastic reductions in the tariff charges which, if accepted, would result in a loss of annual revenue amounting to £225,000 as compared with the 1934 figures, which were taken by the Committee as a basis for its calculations. To cover this the Committee made various proposals, including the restriction of the total amount made available each year for the service of debentures, for income tax, and other obligatory charges and for dividends; and it would fix this figure at the equivalent of 7 per cent. on the net assets, not share capital. Much consideration had been given to the proposals, and in pursuance of the company's policy it was intended to reduce the price of the flat rate of 2½ annas per kWh to 2¼ annas which, with a number of minor concessions that were considered feasible, would involve a fall in revenue of £162,000 as compared with the 1934 standards. By various adjustments and economies it was believed, however, that the proposals submitted to the Government could be effected without material interference with the financial structure of the company.

The London Electric Wire Co. & Smiths, Ltd.—Presiding at the annual meeting held on May 7th, Mr. W. J. Terry (chairman and joint managing director) said that during 1935 the prices of raw materials had risen with improved trade, and in December that of copper was 20 per cent. higher than in 1934. However, if the price remained more or less constant there should be no slackening of demand. Improved trading conditions continued and sales showed a steady increase throughout the year; the tonnage output had created a new record, and but for intensive competition a record profit would also have been achieved. Sales in overseas markets were maintained, but development in this direction was still restricted by severe competition, and they were handicapped by the influence of unstable foreign exchanges. Much attention had been given during the year to development and research. Owing to the uncertain international situation it was more difficult than usual to give any forecast, but if normal conditions continued and the recent trade improvement was maintained, the electrical industry should flourish and they should receive a proportionate share of such benefit. To minimise uneconomic competition a measure of co-operation between manufacturers in their industry existed, but such arrangements had attendant difficulties and would only be maintained if fair and equitable to all parties. Morover, to be lasting, arrangements of this kind must have as an ultimate objective the supply of products at economic prices, and the rendering of the best service to customers. In conclusion, he said it was the intention of the directors to raise the interim ordinary dividend this year to 2 per cent., as against 1¼ per cent. in recent years.

The Oriental Telephone & Electric Co., Ltd., held its annual meeting on May 12th, when Sir A. Henry McMahon (chairman), who presided, said that the Bombay Telephone Co. was embarking upon an extensive scheme of capital expenditure necessitated by the expansion of its business, and also by the need for modernising portions of its existing equipment. The cost was estimated at about 34 lacs of rupees. Part could be furnished out of the Bombay Company's own resources, but the parent company had undertaken to finance them to the extent of £60,000. In Singapore, an important contract was expected to mature shortly that would require a substantial outlay in addition to the normal expenditure on capital account. The progress at Singapore continued, and during the year 235 exchange lines were added to the system, making a total of 4,415. There had been a falling off in the number of subscribers in Mauritius, but this was due entirely to the withdrawal of certain Government lines, without which defection there would have been an increase of 13. Satisfactory progress had been made by the Bombay Telephone Co., Ltd., which had added 1,549 exchange lines during the year. The Bengal Telephone Corporation also continued to make good progress, while the Madras Telephone Co., Ltd., showed an increase of 136 exchange lines. The Rangoon Telephone Co., Ltd., recorded a gain of 32 exchange lines, as against a reduction last year. The chief asset of the China & Japan Telephone & Electric Co., Ltd., consisted of its shareholding in the Hong Kong Telephone Co., Ltd., and although this company reported a slight decrease in the number of subscribers during the past year, there was a partial recovery during the first two months of the current year.

The Ever Ready Co. (Great Britain), Ltd., reports a net profit for the year ended March 31st last of £482,780, as compared with £449,579 in the preceding year, which included a surplus of £19,899 on the sale of investments. To the net profit is added £56,604 brought in. A sum of £160,781 is placed to reserves and the staff benevolent fund receives £6,676. The final dividend on the ordinary stock is 25 per cent., maintaining the distribution for the year at 35 per cent., and the balance carried forward is £59,152. The report states that sales advanced by approximately 9½ per cent. and the reduction in profit caused by lower selling prices of the company's products introduced in January, 1935, was almost entirely offset by savings in the cost of production. The Irish Free State Company had a profitable year's trading, and has recommended a dividend of 7½ per cent. on the ordinary shares. Meeting: June 4th.

The N.V. Hollandsche Draad en Kabelfabriek, of Amsterdam, reports that the results for 1935 were better than in the previous year as a consequence of the further economies which were effected and the fact that very little had to be written off the stocks of raw materials. Concerning the import trade the report mentions that the Dutch quota system was maintained for most of the products made by the company, and the nominal percentage was reduced from 65 to 40 per cent. of the imports in the comparable period. However, as the commercial treaty quotas of the principal importing countries remained unchanged, the lowering of the legal percentage did not result in any increase in the company's work. There had been a further decline in the export trade owing to the maintenance or accentuation of the import restrictions of various countries in the form of high duties, clearing arrangements and quotas. The currency depreciation in all important competitive countries and the amount of the direct export aid which was given abroad rendered competition in the remaining markets too unequal for the company to be able to sustain its position. Despite all efforts the company's already reduced exports declined by about one half. The directors conclude that the future depends on the development of the inland market which, as well as the whole economic position of Holland, is steadily retrogressing. The accounts reveal a small loss (9,710 fl.) for 1935, which is added to the deficit brought forward.

The Southern Areas Electric Corporation, Ltd., held its annual meeting on May 11th, when Viscount Elibank (chairman), who presided, said that the sales of electricity during the year under review showed an increase of 37 per cent. They had connected up an additional 1,542 consumers, bringing the total connections to 10,816. The average price received per kWh fell from 2.77d. to 2.38d., which meant a reduction to consumers of £13,570 during the year. The amount due to the bankers at December 31st last stood at £416,918, and this had since increased to £430,000. The bank had agreed to meet their requirements on favourable terms until such time as they made a

public issue. Last year the authorised capital was increased to £850,000, and they had it in mind to make an issue in a few weeks' time and to give shareholders and consumers in their subsidiary companies preferential allotment. The results at Brentwood showed substantial improvement. They had recently negotiated new and more favourable terms for a bulk supply. These terms came into operation on January 1st, 1935, and were enabling them to revise their tariffs. As regards their electrical manufacturing subsidiary, Mawdsley's Ltd., the results for 1935 exceeded expectations, especially as output was handicapped during the year by works additions and alterations, and by the replacement of sundry new machine tools for old.

Heatrae, Ltd.—Particulars of this company were published on Tuesday last for information only. It has an authorised capital of £100,000, of which £75,000 has been issued in 25,000 6 per cent. cumulative preference £1 shares and 500,000 ordinary shares of 2s. each. The registration of the company was recorded in our last issue, and it has been formed to take over the business of the private company of the same name at Norwich. The business was founded in February, 1920, under the name of Electric Fires, Ltd. In its initial stages the manufacture of electric fires formed the major portion of the business, but from 1925 onwards the manufacture of electric water heaters was specially developed, and this is to-day the most important department. In addition, the manufacture of electric fires, electric heating apparatus, electric oil heaters, immersion heaters, kettles, warming plates and various specialised types of electrical apparatus is also carried on. Mr. C. H. Smith and Mr. F. L. Newhouse, who have acted as joint managing directors since the inception of the business in 1920, have entered into agreements to serve the company as joint managing directors for a period of seven years. Based on the profits for the year ended February 29th last and after deducting the dividend on the issued preference shares, there is a balance equivalent to over 21 per cent. on the issued ordinary share capital.

Franco Signs, Ltd.—Particulars of this company were published on May 12th for information only. The company was formed on May 8th last, with a capital of £200,000 in 10s. shares, to acquire the whole of the share capital of the Franco-British Electrical Co., Ltd., and of its associated companies. The company being only a holding company, requires no working capital. The Franco-British Electrical Co., Ltd., owns a factory at Hendon covering an area of 37,500 sq. ft. with plant and machinery for the manufacture of signs and allied products. To cope with current business and to meet the anticipated expansion of the business the factory is now being enlarged by approximately 30 per cent. The directors estimate that in the six months to March 31st last a net profit in excess of £20,000 has been earned, out of which the cost of this factory extension will be met. Since February, the end of the last financial year, the company's trade has been fully maintained in comparison with that for the corresponding period of last year.

The Calcutta Tramways Co., Ltd.—Presiding at the annual meeting held on Tuesday last Sir Geoffrey R. Clarke (chairman) said that during the past year, despite intense bus competition, there were 101,500,000 passengers carried as compared with 98,300,000 in 1934, while the mileage increased by 400,000 to 9,800,000. The service had been improved by the inclusion of twenty more articulated units. With the growth of Calcutta applications had been made to the Corporation for the extension of the tramway system, but these had not been granted, and they had applied for the right to run trolley buses. The final decision on this point had not yet been given. Under the company's agreement, the Corporation had the right to purchase the undertaking at the end of seven years, and until it was possible to come to some arrangement whereby the company's tenure would be secured over a reasonable period, it was obvious that no considerable capital expenditure on the expansion of the undertaking would be justified. The appointment of Mr. R. O. Law as a director to fill the vacancy caused by the death of Mr. Elston was confirmed.

Telephone Properties, Ltd., reports a net profit for 1935 of £35,687 against £36,427 for 1934. A final ordinary dividend of 3 per cent. is proposed, again making 5 per cent. for the year, and the balance forward is increased from £11,366 to £13,395. The rates of sterling exchange have again had the effect of increasing the receipts shown in the profit and loss account, but on the other hand a higher rate of dividend was declared by the subsidiary company in respect of 1935. In November last £150,000 six per cent. first mortgage debenture stock, being the unissued balance of the authorised amount of £300,000. was allotted to the Telephone & General Trust for cash at par, ranking for interest as from November 27th last. It is now proposed that the 288,528 8 per cent. cumulative preference shares of £1 be converted into £288,528 of 8 per cent. cumulative preference stock, and similarly that the 410,932 ordinary shares of £1 be converted into £410,932 of ordinary stock.

The St. Austell and District Electric Light and Power Co.—A meeting was held on Tuesday last at which proposals were submitted for increasing the capital from £60,300 to £110,300 by the creation of 40,000 4½ per cent. cumulative second preference shares of £1 each and 10,000 ordinary shares of £1. The preference shares have been privately placed at par, and the directors recommend a bonus of one ordinary share for every five ordinary shares held. This will absorb 6,000 of the additional ordinary shares and the remaining 4,000 shares will be issued at 35s. per share in the rate of two new shares for every fifteen held.

The Telegraph Condenser Co., Ltd., held its annual meeting on May 12th, when Mr. S. G. Brown (chairman), who presided, said that the company's output expressed in sterling showed a substantial advance over last year, but expressed in terms of condenser units it showed an even greater increase. Over £10,000 had been spent during the year on additions to buildings, and they had under consideration further expenditure under this heading.

The British Electric Traction Co. reports a revenue for 1935 of £505,245, as compared with £465,514 for the preceding year. The net profit, subject to audit, is £331,600, an increase of £32,098. The final dividend on the deferred ordinary stock is 2½ per cent., again making 5 per cent., together with the usual bonus of 10 per cent. in fully paid £1 deferred ordinary shares. A balance of £87,465 is added to the undivided profits account.

Richard Johnson & Nephew, Ltd., report net profits for the year ended March 31st last of £33,502, as compared with £25,561 in 1934-35, the latter figure including unspecified transfers from taxation and contingency reserves no longer required. The ordinary dividend for the year is 6 per cent. (against 4 per cent.) and £36,410 is carried forward, against £32,777 brought in.

Edmundson's Electricity Corporation, Ltd., is paying a final dividend of 4½ per cent. on the ordinary shares, making 8 per cent. for the year.

The results of the operations of the group of companies during April, as compared with the corresponding month of 1935, show an increase of 20 per cent. of kWh sold.

The East African Power & Lighting Co., Ltd., has declared a final dividend of 4 per cent., maintaining the distribution for the year at 7 per cent.

The Delhi Electric Supply & Traction Co., Ltd., has announced that the dividend for the year is being maintained at 12 per cent. by a final dividend of 8 per cent., tax free.

The Craigpark Electric Cable Co., Ltd.—The directors report that they are unable to pay a preference dividend on May 15th. (Preference dividend paid to September 30th, 1933.)

The Associated Equipment Co., Ltd., has declared an interim dividend of 5d. per £1 unit of ordinary stock, tax free (same).

Siemens Bros. & Co. propose to pay a dividend of 6 per cent. on the ordinary shares for 1935 (against 4 per cent. for 1934).

The Ebonite Container Co. reports a net profit for the year ended February 29th last of £15,740, as against £11,479 in the preceding year. The final dividend is 10 per cent., and a bonus of 2½ per cent., making 16½ per cent. for the year (against 14 per cent.), and £7,379 is carried forward.

Warner's Radio & Electric, Ltd., is paying an interim dividend at the rate of 30 per cent. per annum for the first period from December 18th, 1935, to March 31st, 1936.

Telephone Rentals, Ltd., has announced a final dividend of 5 per cent., less tax, making 8½ per cent., less tax, for the year (against 8 per cent.). The capital was increased by £100,000 to £700,000 in June last.

Stocks and Shares

TUESDAY EVENING.

THE outstanding financial feature of the moment is the speculation as to which way the French rate of exchange will move. Recent events have revived the impression that France will have to go off gold, to quote the cant phrase, and that such action may be followed by disturbances in securities that are affected in any way by French affairs. A general dullness has settled over many of the markets of the House, including those of the gilt-edged sections, nor has it left unscathed the markets which deal in industrial stocks and shares. The amount of selling is not particularly large; on the other hand, buying power has been curtailed by apprehensions current in respect of the franc. The United States markets also feel the effect of this influence, prices of American issues having given way on the idea that if the franc is devalued, this might cause a good deal of selling on the part of French holders of American stocks and shares.

Where everything is so uncertain as it is at the present time in the political and financial worlds, nervousness is bound to make itself felt.

Electricity Supply Shares

A drop of 1s. 6d. to 63s. in Electric Supply Corporation shares, is one of the few price changes worthy of notice in the electricity supply market. There were signs that the success of the County of London company's new debenture issue, and the Electricity Commissioners' report of a 17 per cent. increase in the number of units generated during the first four months of this year over the corresponding 1935 figures, would attract a little more attention to the market. Apathetic conditions still prevail, however, and prices are, in the main, not quotably altered. Small losses are shown by British Power & Light at 31s. 3d., Hendons at 54s. 6d., Newcastles at 35s. 6d., and Llanellys at 25s. 3d. Scottish Power are a little better at 43s. 6d., and West Gloucestershire Ordinary stock are 123, against 120 last week and 111 a month ago. North Eastern ordinary and 7 per cent. preference each gained 6d. to 35s. Edmundson's Electricity Corporation is repeating the previous year's 8 per cent. dividend distribution.

Palestine "A" shares sagged from 49s. 6d. to 48s., and Jerusalems to 37s. 6d., in the absence of reassuring news of the country's condition. East Africans are a shade lower at 33s.

A New Debenture Stock

Dealings began last Friday in the 3¼ debenture stock issued at 100 by the County of London Electric Supply Company. The price opened at ⅛ premium and has since hardened to 15s. premium. At this, the stock pays £3 4s. 7d. per cent. per annum on the money. Comparable stocks are the 3½ per cent. debentures of the North Eastern Electric and London Power companies, both of which stand around 103. A premium of 3 on the County of London stock would not be unreasonable to expect.

The loan ranks *pari passu* with the existing 5 per cent. debenture stock and is redeemable at par between 1952 and 1972. Dividends of 10¼ per cent. have been paid annually on the ordinary shares for the last four years, and the company's business is expanding in a progressive manner.

Electrical Equipment Price Level

Johnson and Phillips shares improved to 46s. 3d. in recognition of the company's success outlined at the annual meeting. A good deal of what was said at the meeting is of significance to the shareholders of electrical equipment manufacturing companies generally. Particularly important is the chairman's emphasis on the fact that progress is being made in the face of a persistence of a low price-level throughout the industry. The increase in the company's profits in 1935, which enabled the dividend to be raised to 10 per cent., was due to the greater number and size of the orders booked; there was no assistance in the shape of an improvement in the value of the individual orders. Prices continued to be uncomfortably—in some cases even unremuneratively—low. The hopeful outlook for the industry was, however, given due prominence. Sir Philip Dawson drew attention to the scope that still exists in the domestic and industrial fields, and in the electrification of railway systems.

The tone of the London Electric Wire & Smiths Company's meeting was pitched in the same key. Intensive competition and low prices prevented profits from keeping fully in step with the progressive output. Earnings rose, nevertheless, sufficiently to warrant the distribution of a dividend of 6¼ per cent., against the previous year's 5 per cent. The shares are rather firmer at 30s. ex dividend.

Manufacturing Companies' Shares

The 2 per cent. increase in the Siemens Company's dividend was in line with expectations and failed to affect the price of the shares. The company has evidently taken advantage of improved trading conditions. The electrical equipment market, as a whole, is idle, but steady. The factors which discourage buyers from entering the market are counterbalanced by a reluctance of holders to part with their shares while the domestic industrial outlook at home remains good.

Henley's are still on the dull side, at 7¼, having failed to respond to the full report. Comparison of the results with those of the previous year is a difficult matter, owing to differences in the accounts, but it is clear that satisfactory progress has been made. Aron Meters and Electric Constructions are heavy at 3⅞ and 1½ respectively. Reyrolles recovered well to 70s. 9d. Among telephone shares, Ericssons are changing hands about 1/16 higher than the official quotation of 2 3/16, and International Automatic ordinary, at 47s., Telephone Manufacturing, at 9s. 3d. ex dividend, and Telephone Rentals, at 10s., are all harder. Telegraph Condensers shed 1/16 to 2¼ ex dividend. Babcock & Wilcox dropped below 2½. The mere maintenance of the dividend at 8 per cent. for 1935 still rankles in the minds of some disappointed shareholders.

Telegraphs and Telephones

Cable and Wireless stocks fluctuate gently while interest is agog on the near approach of the date for publication of the all-important report. The preference stock stands rather higher on the week at 111½, but the "A" stock is ¾ lower at 28.

The rot in American stock prices has, for the present, at least, been checked. The slight upswing which followed a month of headlong falls, has carried some of the electrical communication stocks with it. American Telephone and Telegraphs, for instance, regained 4 points of last week's 10 point fall. Internationals, however, at 13, and Western Unions, at 75, are no better, despite the fact that the latter company's net revenue in the first quarter of this year quadrupled the comparable figure for 1934. Radios sagged further to 10. Anglo-American Telegraphs came in for support on the report. The preferred gained 1 to 124½ and the deferred ½ to 30. Elsewhere, Canadian Marconis weakened to 8s. Anglo-Portuguese Telephones moved up to 29s. 9d. Telephone Properties, at 13s. 9d., were unmoved by the report and the repetition of a 5 per cent. dividend for the year.

Miscellaneous Matters

Electric and Musical Industries, after touching 26s. 3d., reacted to 25s. 6d. With the final dividend announcement not far off, E. K. Coles are erratic. The shares are 3d. higher on the week at 28s. 3d. after being 29s. There is talk of a final distribution of 27½ per cent., which would make a total dividend of 40 per cent. for the year: 30 per cent. was paid for 1934.

Tillings are on the heavy side at 70s. 6d.: British Electric Traction deferred fell 50 points to 1550, although the accounts, just published, show an increase in the company's revenue. The dividend of 5 per cent. is the same as for the preceding year, and a 10 per cent. scrip bonus is to be distributed. The London Passenger Transport Board "C" stock is a point down at 103.

Brazilian Tractions, 10¾, and International Holdings, 1⅛, shared, to a small extent, in the tentative revival of American stocks. Hydro Electrics show no improvement at 6⅛.

International Combustions are an outstanding feature amongst the new issues, having jumped 3s. to 98s. 6d. Pressed Steels advanced from 23s. 9d. to 24s. 6d. Vactrics and British Vacuum Cleaners are good at 26s. and 37s. 6d. respectively.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. Previous.	Dividend. Last.	Price May 12.	Rise or Fall.	Yield £ s. d.
Bournemouth and Poole	1	15	15	77/6	—	3 17 5
City of London	1	7½	7½	37/6	—	4 0 0
Clyde Valley	1	7	8	45/-	—	3 11 1
County of London	1	10½	10½	56/6	—	3 14 4
Edmundson's 7% Pref.	1	7	7	36/-	—	3 17 9
Do. Ord.	1	8	8	45/-	—	3 11 1
Elec. Dis. Yorkshire	1	9	9	47/-	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	63/-	−1/6	3 9 10
Lancs Light and Power	1	7½	7½	39/-	—	3 17 0
Lond. Assoc. Electric	1	—	7	34/6	+6d.	4 1 2
London Electric	1	7	8	40/-	—	4 0 0
London Power Deb. Red.	Stock	5	5	108½	+1	4 12 2
Metropolitan	1	10	10	52/-	—	3 17 0
Midland Counties	1	7	7½	41/-	—	3 13 2
Mid. Elec. Power	1	8	8	42/-	—	3 16 2
North Eastern Electric Ordinary	1	6	6	35/-	+6d.	3 8 7
Do. 7% Pref.	1	7	7	35/-	+6d.	4 0 0
Northampton	1	10	10	53/9	—	3 14 5
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	3	—	3 6 8
Do. do. 6% Pref.	1	6	6	32/-	—	3 15 0
Scottish Power	1	8	8	43/6	+3d.	3 13 7
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/-	—	3 9 7

Public Boards.

Central Electricity, 1950–70	Stock	5	5	118	—	4 4 9
Do. 1955–75	,,	5	5	120	—	4 3 4
Do. 1951–73	,,	4½	4½	112	—	4 0 4
Do. 1963–93	,,	—	3½	102xd.	—	3 8 8
London Elec. Trans. Gtd.	,,	—	2½	97	—	2 11 7
London & Home Counties, 1955–75	,,	4½	4½	113	—	3 19 8
London Passenger Transport, A	,,	—	4½	125½	—	3 11 9
Do. do. B	,,	—	5	129	—	3 17 6
Do. do. C	,,	3½	4	103	−1	3 17 8
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10

Telegraph and Telephone.

American Tel. & Tel.	$100	9	9	156½	+4	5 15 0
Anglo-Am. Tel. Pref.	Stock	6	6	124½	+1	4 16 5
Do. Def.	,,	1½	1½	30	+½	5 0 0
Cable & Wireless 5½% Pref.	,,	4½	5½	111½	+½	4 18 8
Do. A. 7½% Ord.	,,	Nil	Nil	28	−¾	—
Do. B. Ord.	,,	Nil	Nil	8	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16½	—	2 3 4
Do. do. Pref.	10	6	6	14½	+½	4 4 3
Great Northern Tel.	10	20	20	44	—	4 11 0
Marconi-Marine	1	10	7½	32/6	—	4 12 4
Oriental Telephone Ord.	1	12*	12*	3¼xd.	—	3 16 10

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1550	−50	—
Do. do. Pref. Ord.	,,	8	8	181½	—	4 8 2
Brazil Traction	100	—	—	10¾	+¼	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	102½	—	4 17 7
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	77/6	—	—
West Riding	1	5	6½	52/6	—	2 9 6

Manufacturing Companies.

Aron Electricity Ord.	1	10	15	66/3	−½	4 10 7
Assoc. Elec. Ord.	1	6	8	46/6	—	3 8 10
Do. Pref.	1	8	8	39/-	—	4 2 1
Babcock & Wilcox	1	8	8	49/6	−1/9	3 4 8
British Aluminium Ord.	1	7½	7½	40/-	—	3 15 0
British Insulated Ord.	1	15	20	5½	—	3 14 5
Brush Ord.	Stock	Nil	Nil	42½	+2	—
Callender's	1	15	15	4½	—	3 6 8
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/-	—	12½	62/6	—	1 0 0
Do. 8% Pref.	1	8	8	2	—	4 0 0
Edison Swan 1st Pref.	1	7½	7½	30/-	—	5 0 0
Electric Construction	1	Nil	3½	1½	−¼	2 0 0
Enfield Cable Ord.	1	25	25	5½	—	4 13 0
English Electric	1	Nil	Nil	22/-	—	—
Do. do. Pref.	1	Nil	Nil	25/6	—	—
Ericsson Tel.	5/-	24	20*	2 1/8	—	2 5 8
Ever Ready	5/-	35	35	25/6xd.	—	6 17 3
Ferranti Pref.	1	7	7	27/-	—	5 3 8
G.E.C. Pref.	1	6½	6½	33/-	−1/-	3 18 9
Do. Ord.	1	8	10	79/-	—	2 10 8
Henleys	1	30	30	7½	—	4 2 9
Do. 4½% Pref.	5	4½	4½	5½	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	46/3	+3/8	4 6 6
Lancashire Dynamo	1	5	10	2½	—	4 9 0
Siemens Ord.	1	4½	6	28/9	—	2 15 8
Telegraph Construction	£1	Nil	Nil	26/3	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

19957. "Rotary electric switches particularly for flashing signs." F. H. Wingrave. August 13th, 1934. (445609.)

1934

23432. "Electric heat radiators," L. C. H. Athill. August 14th, 1934. (445532.)

23665. "Electric spot-welding installations." D. Sciaky. August 16th, 1933. (445689.)

25664. "Cathode-ray tubes." Ferranti, Ltd., and M. K. Taylor. September 6th, 1934. (445464.)

25994. "Electric heater for water and other liquids." H. S. Wallis. September 10th, 1934. (445767.)

26464. "Electrical high-frequency oscillating circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. September 14th, 1934. (445543.)

28564. "Magnetic-dust cores." Kinzoku Zairyo Kenkyusho. April 21st, 1934. (Addition to 414657.) (445614.)

28731. "Device for winding up electric flexible cords." F. W. Heusinkveld and E. G. Brauckmann. October 8th, 1934. (Convention date not granted.) (445548.)

28914. "Thermostatic switches particularly suitable for use in electric discharge devices." British Thomson-Houston Co., Ltd., and H. R. Ruff. October 9th, 1934. (445475.)

28932/3. "Control apparatus for alternating current commutator motors." W. B. Bennitt and Associated Electrical Industries, Ltd. October 9th, 1934. (445694/5.)

29043/4. "Electric motor control systems." British Thomson-Houston Co., Ltd. October 11th, 1933. (445557/445772.)

29048. "Thermionic valve circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and O. E. Keall. October 10th, 1934. (445558.)

29108. "Electrically driven centrifugal machines." Watson, Laidlaw & Co., Ltd., and H. Watt. October 11th, 1934. (445566.)

29144. "Electric control systems for apparatus operating on a strip of material." British Thomson-Houston Co., Ltd. October 11th, 1933. (445479.)

29211. "Electric couplings." J. E. Stewart. October 12th, 1934. (445570.)

29242. "Electromagnetically actuated horns." J. Lucas, Ltd., and S. A. Mason. October 12th, 1934. (445573.)

29254. "Electric-discharge devices." General Electric Co., Ltd., and V. J. Francis. October 12th, 1934. (445575.)

29278. "Permanent magnet generators used as tachometers." British Thomson-Houston Co., Ltd., and L. Griffiths. October 12th, 1934. (445577.)

29279. "Vacuum tubes or electric-discharge devices. British Thomson-Houston Co., Ltd., L. J. Davies and C. E. Fenwick. October 12th, 1934. (445578.)

29280. "Electric-discharge devices." British Thomson-Houston Co., Ltd., and W. J. Scott. October 12th, 1934. (445579.)

29292. "Electrical signalling systems." Automatic Electric Co., Ltd., and S. Bolshaw. October 12th, 1934. (445580.)

29312. "Thermionic valve circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and E. H. Trump. October 12th, 1934. (445582.)

29597. "Plates for secondary batteries." J. Stone & Co., Ltd., A. H. Chilton and W. Schofield. October 16th, 1934. (445708.)

29631. "Electrical condensers." R. B. Peacock, K. L. Sanders and Imperial Chemical Industries, Ltd. October 16th, 1934. (445710.)

29668. "Electric fuses for overhead distribution lines." R. T. Norton and J. E. Stewart. October 17th, 1934. (445778.)

29725. "Control systems for electric motors." British Thomson-Houston Co., Ltd., and B. Adkins. October 17th, 1934. (Addition to 424005.) (445782.)

29986. "Electric-discharge devices provided with thermostatic switches of the bimetallic strip type." British Thomson-Houston Co., Ltd., and H. R. Ruff. October 19th, 1934. (445789.)

30240. "Means for controlling vapour-arc convertors." General Electric Co., Ltd., and H. H. Taylour. October 22nd, 1934. (445791.)

30548. "Television transmitting apparatus." J. D. McGee and G. S. P. Freeman. October 24th, 1934. (445485.)

30643. "Electric condensers." Dubilier Condenser Co. (1925), Ltd. (W. Dubilier.) October 25th, 1934. (445717.)

30833. "Signal lights." C. G. Rask. October 27th, 1934. (445627.)

31254. "Holders for vacuum tubes." Electrical Research Products, Inc., and R. J. Miller. October 31st, 1934. (445486.)

31303. "Electroplating." A. R. N. Heath and T. C. Tapp. November 1st, 1934. (445719.)

31875. "Incandescent electric lamps." Z. Dezsoe. November 6th, 1934. (445489.)

32317. "Dynamo-electric machines." Westinghouse Electric & Manufacturing Co. November 11th, 1933. (445490.)

34454. "Electric condensers." Porzellanfabrik Kahla. November 30th, 1933. (Cognate application 34455/34.) (445495.)

34520. "Remote control of the tuning of a radio receiver." E. K. Cole, Ltd., and A. W. Martin. Dec. 1st, 1934. (445496.)

34754. "Light valves." E. Traub. December 4th, 1934. (445498.)

34994. "Electron-discharge tubes." Naamlooze Vennootschap Philips' Gloelampenfabrieken. March 23rd, 1934. (445499.)

37395. "Electric-discharge devices." British Thomson-Houston Co., Ltd. December 29th, 1933. (445593.)

1935

358. "Electrical signalling means." Gentral Electric Co., Ltd., and S. W. Richards. January 4th, 1935. (445596.)

7032. "Electric circuit arrangements for use in conjunction with electric-discharge devices." General Electric Co., Ltd. (Patent Treuhand Ges. für Elektrische Glühlampen). March 6th, 1935. (445604.)

9415. "Electrostatic charging apparatus." J. Barthel and H. Huebner. March 26th, 1935. (445644.)

10462. "Electron-discharge devices." Rogers Radio Tubes, Ltd. April 4th, 1934. (445738.)

11587. "Electric-discharge devices." General Electric Co., Ltd. (Patent Treuhand Ges. für Elektrische Glühlampen.) April 15th, 1935. (445648.)

12787. "Time - operated switch mechanism." T. J. McNamara. April 29th, 1935. (445740.)

18085. "Synchronous-motor alarm clocks." A. P. Thurston (Junghans Akt.-Ges. Geb.). June 24th, 1935. (Convention date not granted.) (445659.)

19663. "Quick-action electric switches suitable for controlling refrigerating plants. R. Bosch Akt.-Ges. July 27th, 1934. (445745.)

19684. "Means for moving from the outside of an airtight enclosure, such as a cathode ray tube, a body disposed within the enclosure. F. J. G. Van Den Bosch. July 10th, 1935. (445507.)

19685. "Manufacture of cathode-ray tubes." F. J. G. Van Den Bosch. July 10th, 1935. (445820.)

20616. Ray-reflection system for Braun tubes." C. Lorenz Akt.-Ges. July 30th, 1934. (445665.)

21877. "High-frequency telegraph transmitters." Telefunken Ges. für Drahtlose Telegraphie. August 4th, 1934. (445668.)

23976. "Method and systems for distributing signal currents." F. R. Tate (Radio Systems, Inc.). August 27th, 1935. (445748.)

25291. "Track circuits for railways." General Railway Signal Co. May 29th, 1935. (445515.)

25576. "Cathode-ray oscillographs and other electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 12th, 1934. (445676.)

28630. "Connectors for electrical conductors." V. G. Manufacturing Co., Ltd., and F. M. Van Gelderen. October 16th, 1935. (445679.)

29971. "Electric conductors and method of insulating them." British Thomson-Houston Co., Ltd. October 31st, 1934. (445682.)

31832. "Cathode ray tubes." F. J. G. Van Den Bosch. July 10th, 1935. (Divided out of 445820.) (445523.)

33866. "Excess electricity consumption meter." Landis & Gyr Akt.-Ges. December 20th, 1934. (445762.)

34653. "Arrangements for eliminating disturbances in radio receiving sets." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 1st, 1935. (445763.)

35813. "Cooling devices for gas- or vapour-discharge tubes of glass, especially mercury-vapour rectifiers of glass, in which the discharge tube is disposed in a receiver containing a liquid." Jenaer Glaswerk Schott & Gen. December 31st, 1934. (445831.)

35959. "Method and device for the reproduction of sound." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 17th, 1935. (445765.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 6th :—

Crysteel. No. 566280. Class 6. Refrigerating machines, &c. —The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.

Duode. No. 565733. Class 8. Loud speakers.—The Benjamin Electric Co., Ltd. (address as above).

Onyx. No. 563665. Class 8. Electric batteries (not for medical purposes).—The Jewell Battery Co., Ltd., 7, Lincoln's Inn Fields, W.C.2.

Uvet. No. 567739. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Radiometers, Ltd., Dunbar Works, Dunbar Road, West Norwood, S.E.27.

TM, Teesmade, Limited (lettering and design). No. 565625. Class 10. Electric clocks.—Teesmade, Ltd., 11a, Cambridge Works, Cambridge Road, Hanwell, W.7.

Town Crier (design only). No. 564444. Class 13. Electric lamps (ordinary), torches, pocket lamps, electric lighting, heating and power fittings, electric milk warmers, bed warmers, water boiling utensils, saucepans, frying pans, kettles, coffee percolators, tea infusers, &c.—Lissen, Ltd., Angel Road, Edmonton, N.18.

Nyhax. No. 566583. Class 50. Electrical insulating materials, of pressed impregnated paper and/or textile fabric, or of asbestos, mica, resins, shellacs, gums, oils, or bitumen; moulding or plastic compositions made wholly or principally of natural or synthetic resins or similar material and sold in the form of powder, granules, rods, tubes, sheets, slabs or blocks.—New York-Hamburger Gummiwaaren Compagnie, Hamburg, Germany (British representatives, D. Young & Co., 11-12, Southampton Buildings, Chancery Lane, W.C.).

Holmes Memorial Lectures

An effort is being made, particularly in the north-eastern area where he was more intimately known, to raise a fund for perpetuating the memory of the late John H. Holmes who, as a partner in the firm of J. H. Holmes and Co., did pioneer electrical work more than fifty years ago. The intention is to found a lecture for children to be delivered annually, modelled on the Christmas lectures of the Royal Institution in London, which were inaugurated by Faraday. Armstrong College, Newcastle-on-Tyne, is to act as the perpetual trustee for the fund and to organise the lectures. Donations should be sent to Mr. H. B. Poynder, "Eastnor," Jesmond Park, Newcastle-on-Tyne, 6.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Intermediate school, Sunnyside area, for Corporation E.C.; the city architect.

Annan.—Houses (48); J. I. Rodger, burgh surveyor.

Ashington.—Bus station, for the United Automobile Services, Ltd.

Bath.—Houses (108); city surveyor.

Battle (SUSSEX).—Houses (100); R.D.C. housing architect.

Bilston.—Houses (276); W. G. Lofthouse, architect, Town Hall.

Birmingham.—School, Quinton; director of education.

Bolton.—Houses (22), near Chorley Old Road; T. P. Smith, Ltd. Houses (46), Long Lane; David Reid. Houses (150), Willows estate (£47,000); borough engineer. Extensions to works, Bridgeman Street; Wm. Wadsworth & Sons, Ltd. Extensions to works, Salop Street; T. Carling & Co., Ltd.

Boston.—Cinema, South Square, for Odeon Theatres, Ltd.; H. W. Weedon, architect, Birmingham.

Braughing (HERTFORDSHIRE).—Houses (28); E. G. Thody, R.D.C. surveyor, Bridgefoot House, Buntingford.

Burnley.—R.C. church, Manchester Road; Rev. Father H. Bolger.

Bury (LANCASHIRE).—School (300 places), Deal Street; M. Tomlinson, director of education. Houses (30), Bolton Street; borough engineer.

Cardiff.—Houses, Wood Street, &c., and tenements, Bute Street; city architect.

Carlisle.—Two schools (£50,000) for E.C.

Chanctonbury (SUSSEX).—Houses (30); R.D.C. surveyor, Storrington, Pulborough.

Chard.—Cinema, Fore Street, for H. Stevenson.

Cheltenham.—Houses (36), Arle Road; Western Estates, Ltd. Assembly hall, &c. (£62,000); Healing & Overbury, architects.

Cheshire.—Public library, Bredbury; F. A. Browne, county architect, Chester. Central schools, Knutsford; director of education, Chester.

Chester-le-Street (DURHAM).—Houses (50), Chester Moor; U.D.C. surveyor.

Chorley.—Cinema, Bolton Street, for Jefton Entertainments, Ltd.

Coventry.—Factory, Canley, for the British Lorraine Aircraft, Ltd.

Crook (Co. DURHAM).—Houses (94), for the North-Eastern Housing Association, Ltd., Newcastle-on-Tyne; Thornton Construction Co., builders, Stockton-on-Tees.

Croydon.—School, South Norwood (£21,595), for E.C.

Dagenham.—Factory, for the Teddy Toy Co., 1, Nicholls Buildings, Playhouse Yard, London, E.C.1.

Dewsbury.—Houses (200); borough surveyor.

Dudley.—Houses (54), Selborne Road, and shops, Council estates; borough engineer.

Edwinstowe (NOTTS).—Cinema, for the Edwinstone Theatre Co.

Flint.—Houses (90), near Manor House Farm; E. M. Bellis, builder, 149, Mill Lane, Liscard, Wallasey.

Gloucestershire.—Grammar schools and technical colleges, Cheltenham (£160,000); director of education, Gloucester.

Greenford (MIDDLESEX).—Church, for the Baptist Union, 4, Southampton Row, London, W.C.1.

Hampshire.—Senior school, Cove (320 places), for County E.C.; A. L. Roberts, county architect, The Castle, Winchester.

Hastings.—Houses (30), Parker Road; T. E. Relfe.

Herstmonceux (SUSSEX).—Houses (26), Hailsham Road, for E. D. Curtis.

Hexham.—Cinema, Priestpopple; J. N. Fatkin, architect, 17, Bigg Market, Newcastle-on-Tyne.

Honington (SUFFOLK).—Royal Air Force Station, Euston estate, for the Air Ministry.

Hull.—Offices, for Storry, Witty & Co., Ltd., Wincolmlee; Gelder & Kitchen, architects.

Hythe (KENT).—Cinema, High Street, for Union Cinemas, Ltd.

Ilkeston.—Houses (46), Richmond Avenue; D. Clegg & Co., Ltd.

Irish Free State.—(PORTLAOIGHISE, Co. LEIX).—County hospital, for the Commissioner acting for the Leix County Board of Health; Scott & Good, architects, 36, South Frederick Street, Dublin. (TULLAMORE, Co. OFFALY).—Technical school, for the Vocational E.C. of the County; Michael Grace, Castle Street, Oldcastle, Co. Offaly. (DUBLIN).—Flats (181), Railway Street site; H. G. Simms, housing architect, 3, Parliament Street, Dublin.

Jarrow-on-Tyne.—School, Primrose, for E.C.; borough engineer.

Kirkburton (YORKSHIRE).—Houses (50), Paddock; U.D.C. surveyor.

Knutsford (CHESHIRE).—Houses (150), Grove House estate, for Mr. Booth.

Lancaster.—Houses (38), Vale Road to Barley Cop Lane; Barrow Bros., builders, Bulk Road.

Leeds.—Houses, Seacroft estate and Halton Moor estate; housing director. Church, Belle Isle housing estate; Leeds Church Extension Society. Cinema and shop, Cross Gates Road; Kenyon & Co. (Builders), Ltd. Cinema, shops and flats, Harrogate Road and Falkland Mount; William Hobson. News cinema, Wellington; L.M.S. Railway Co. Shops, Lidgett Lane and Chandos Gardens; G. W. Atkinson.

Leicester.—School, Anstey Lane (£38,200) for E.C.

London.—(BLOOMSBURY).—Hospital, for the Institute of Medical Psychology, Malet Place, W.C.1. (CAMBERWELL).—Tenements, Sumner Road (£257,000); L.C.C. architect. (FINSBURY).—Reconstruction of Compton Street school (£27,390); L.C.C. architect. (GREENWICH).—Tenements, Haddo Street (£75,000); L.C.C. architect. Reconstruction of Creek Road School (£55,667); C. Miskin & Sons, Ltd., Romeland, St. Albans. (LEWISHAM).—Reconstruction of Forest Hill Central School (£28,340); L.C.C. architect. (POPLAR).—Reconstruction of Cubitt Town School (£35,416); W. H. Gaze & Sons, Ltd., Tennis Courts, High Street, Kingston-on-Thames. (ST. PANCRAS).—Tenements, Carlow Street (£37,800); borough engineer. (SOUTHWARK).—Tenements, St. Margaret's Court, Lant Street, and Zoar Street; L.C.C. architect. (WESTMINSTER).—Premises for St. Martin's School (£100,000), Charing Cross Road; L.C.C. architect. (WOOLWICH).—Clearance and rehousing, Barnfield Road and Princes Road (£80,000); L.C.C. architect.

Lowestoft.—Ritz Cinema, Surrey Street (electrical work), for the Union Cinema Co.; E. Norman Bailey, architect, Maidenhead.

Luton.—Houses (36); David Nott, builder.

Lydney (GLOUCESTERSHIRE).—Houses (45), Holmes Farm site, for the Lydney Advancement Building Co., Ltd.; R. H. Matthews, secretary.

Macclesfield.—Silk factory for Brocklehurst-Whiston Amalgamated Co.; John Clayton, Ltd., builders, Sunderland Street.

Market Rasen.—Senior school; R. M. Phillips & Sons, Ltd., builders, Brigg.

Melksham.—Hospital, with nurses' home and X-ray theatre (£35,000); Sir George Oatley, architect, Bristol.

Newcastle-on-Tyne.—Houses (23), for the Tyne Housing Development Co., Ltd.; Marshall and Tweedy, architects, 129, Pilgrim Street. Hide factory, Walker Road, for G. Angus and Co.; and shops and showrooms, at the corner of Northumberland Street and Prudhoe Street, for Chapman & Co.; Hetherington & Wilson, architects, County Chambers.

New Eltham.—Rebuilding station for Southern Railway Co.

Northampton.—Houses (70), Abbots Way; W. Higgins, Ltd. Houses (30), the Fairway; Chowns, Ltd.

Northumberland.—School, Tweedmouth (£24,650); W. W. Tasker, county architect, County Hall, Newcastle-on-Tyne.

Nottingham.—Cinema, Daybrook; R. W. Cooper, architect.

Nottinghamshire.—Nurses' home, County Hospital, Kilton; county architect.

Oldbury.—Houses (50), Birchley estate; borough engineer. Houses (40), Titford Road; W. Seaton.

Peterborough.—Houses (28), and bungalows; J. T. Cox & Sons.

Pontefract.—Houses (100); W. Horner & Son, Ltd., builders.

Portsmouth.—Cinema, Commercial Road; Associated British Cinemas, Ltd.

Ramsgate.—Underground railway (electrical work), Hereson, to the Cliffs; D. F. Warren, managing director of Ramsgate Olympia, Ltd.

Reigate.—Houses (100); borough surveyor.

St. Erth (CORNWALL).—Dairy factory, for the United Dairies Company, Ltd.; Dauntsey Creamery, Chippenham.

Sandwich (KENT).—Houses (50), Woodnesborough Road, for W. & H. Properties; secretary.

Scarborough.—Girls' school (£52,500); director of education.

Sheen (SURREY).—Cinema (1,850 seats), for the Union Cinema Co., Ltd., 15, Lower Regent Street, London, W.1.

Smethwick.—Extensions to works, Bridge Street; J. A. Phillips & Co., Ltd.

South Shields.—Houses, Cornwallis Square, and Horsley Hill (112 acres); borough engineer. Domestic subjects' centre and gymnasium to the Westoe Secondary school; H. Hill, architect, 10, Winchester Street.

Stoke-on-Trent.—Extensions to Oakhill Council school, for City E.C.; W. G. Robson, Ltd., builder, Sheffield.

Sunbury.—Houses (95), Green Street; Parkwood Estates and Building Co.

Surrey.—Buildings for Art school, Farnham, and central school, Crown Road, Sutton, for County E.C. Residential school, for C.C., on site to be selected; Jarvis & Richards, architects. Extensions to mental hospital, Brookwood; county architect.

Swinton.—Houses (132), Eccles Road; J. Lane & Sons, Ltd., builders, East Lancashire Road.

Tamworth (STAFFORDSHIRE).—Houses (85); borough surveyor.

Treharris.—Church, Trelewis, for the Methodist trustees; E. W. Davies, architect.

Wallsend-on-Tyne.—Maternity and child welfare centre; borough engineer.

Walsall.—Extensions to works, Smith Bros. (Walsall), Ltd., Wolverhampton Street; Best & Saunders, architects, 145, Lichfield Street.

Ware (HERTFORDSHIRE).—Factory, Crane Mead, for A. B. Swain & Co.

Warrington.—Houses (22), Hoyle Street; J. F. Simm. Houses (26), Thellwall Lane; W. Ardern & Son.

Warsop (NOTTINGHAMSHIRE).—Cinema, Church Street, for the Warsop Theatre Co.; Vallance & Westwick, architects, White Hart Chambers, Mansfield.

Watford.—Factory, By-pass Road, for Ault & Wiborg, Ltd., Standen Road, London, S.W.18.

West Hartlepool.—School, Brinkburn, for E.C.; F. Durkin, borough engineer.

Westmorland.—Extensions to Kendale Girls' High School (£30,000); J. R. Tipper, director of education, Kendal.

West Riding.—School (440 places), Queensbury; director of education, Wakefield.

Wetherby (YORKSHIRE).—Houses (40); Pennington, Hustler & Taylor, architects, Ropergate, Pontefract.

Wolverhampton.—School, Penn, for E.C. Houses (26), Pinfold Lane; L. T. Taylor. Houses (24), Warstones Road; J. R. Wooddisse.

Worcestershire.—Senior schools, Catshill, Evesham, and Stourport, for County E.C.

Workington.—Houses (84), Frostrams and Westfield estate; J. Penman, borough surveyor.